ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

INTERNET OF THINGS

B.Tech Four Year Degree Course

(Applicable for the batches admitted from 2020-21)

GUDLAVALLERU ENGINEERING COLLEGE

(An Autonomous Institute with Permanent Affiliation to JNTUK, Kakinada)

Seshadri Rao Knowledge Village

GUDLAVALLERU - 521 356, Krishna District, Andhra Pradesh

CONTENTS

VISION, MISSION
OF THE
COLLEGE & DEPARTMENT
PEOs, POs & PSOs
ACADEMIC REGULATIONS
AND
CURRICULAR COMPONENTS

VISION & MISSION OF THE COLLEGE

Vision

To be a leading institution of engineering education and research, preparing students for leadership in their fields in a caring and challenging learning environment.

Mission

- To produce quality engineers by providing state-of-the-art engineering education.
- To attract and retain knowledgeable, creative, motivated and highly skilled individuals whose leadership and contributions uphold the college tenets of education, creativity, research and responsible public service.
- To develop faculty and resources to impart and disseminate knowledge and information to students and also to society that will enhance educational level, which in turn, will contribute to social and economic betterment of society.
- To provide an environment that values and encourages knowledge acquisition and academic freedom, making this a preferred institution for knowledge seekers.
- To provide quality assurance.
- To partner and collaborate with industry, government, and R and D institutes to develop new knowledge and sustainable technologies and serve as an engine for facilitating the nation's economic development.
- To impart personality development skills to students that will help them to succeed and lead.
- To instil in students the attitude, values and vision that will prepare them to lead lives of personal integrity and civic responsibility.
- To promote a campus environment that welcomes and makes students of all races, cultures and civilizations feel at home.
- Putting students face to face with industrial, governmental and societal challenges.

VISION & MISSION OF THE DEPARTMENT

Vision

To be a leading centre of education and research in Electronics and Communication Engineering, making the students adaptable to changing technological and societal needs in a holistic learning environment.

Articulations

- To be a leading centre of education and research hub in Electronics and Communication Engineering with holistic learning environment.
- Students to be adaptable for the changes in technology and societal needs.
- Students to be recognized and valued for their commitment to excellence and enthusiasm for learning.

Mission

- To produce knowledgeable and technologically competent engineers for providing services to the society.

- To have a collaboration with leading academic, industrial and research organizations for promoting research activities among faculty and students.
- To create an integrated learning environment for sustained growth in electronics and communication engineering and related areas.

Articulations

- To craft the graduates knowledge and technologically competent engineers for providing services to the society.
- To have alliance with leading academicians, industries and research organizations and encourage the faculty and students for performing research activities.
- To develop a multidiscipline learning environment for continuous growth in electronics and communication engineering and its associated fields.

III. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Internet of Things program graduates will

- acquire skills in the core areas of IoT to provide efficient futuristic solutions.
- be capable to adopt IoT technological changes and good career in IoT industry related areas.
- effectively use IoT technology to solve real life, real time and multi-disciplinary problems that caters to the need of society.

IV. PROGRAM OUTCOMES (POs)

The IoT Graduates will be equipped with the ability of

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

V. PROGRAM SPECIFIC OUTCOMES (PSOs)

The Internet of Things program Graduates will be equipped with the ability of

- implementing innovative, cost effective processes for producing energy efficient and eco-friendly IoT applications.
- applying the knowledge of Core, Disciplinary and Interdisciplinary elective courses of Electronics, Communications and Computer Engineering to achieve a logical solution to real world problems.

V. ACADEMIC REGULATIONS

Applicable for the students of B.Tech. from the Academic Year 2020-21.

1. UG – B.Tech. Programs

The following B.Tech. Programs are offered at present

i. Civil Engineering (CE)
ii. Electrical and Electronics Engineering (EEE)
iii. Mechanical Engineering (ME)
iv. Electronics and Communication Engineering (ECE
v. Computer Science and Engineering (CSE)
vi. Information Technology (IT)
vii. Artificial Intelligence and Data Science (AI&DS)
viii. Internet of Things (IoT)

2. Duration of the Program

The duration of the program is four academic years consisting of eight semesters. However, a student is permitted to complete the course work of B.Tech. program in the stipulated time frame of **EIGHT** years from the date of joining. Students admitted into third semester of B.Tech. program directly, through Lateral Entry (LE), shall have to complete the course work of B.Tech. program in the stipulated time frame of **SIX** years from the date of joining.

3. Minimum Instruction Days

Each semester consists of a minimum of ninety instruction days.

4. Award of B.Tech. Degree

i) Each discipline of the B.Tech. program is designed to have a total of **160** credits and the student shall have to complete the four year course work and earn all the **160** credits for the award of B.Tech. Degree.

il) Students, who fail to complete their four years' course of study within eight years from the year of their admission or fail to acquire the **160** credits within this period shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

iii) Students joining the B.Tech. program into the II year 1st semester directly through Lateral Entry (LE) Scheme shall have to complete the three year course work and earn **120** credits for the award of B.Tech. degree.

iv) Students, who fail to complete their three years course of study within six years from the year of their admission or fail to acquire the **120** credits for the award of degree within this period shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

v) **Award of B. Tech. (Honors)** / **B. Tech. (Minor):** B. Tech. with Honors or a B.Tech. with a Minor will be awarded if a student earns 20 additional credits as per the regulations/guidelines. Registering for Honors / Minor degree is optional.

5. Duration and Pattern of the Program

i) The duration of the program is four academic years consisting of eight semesters for regular students and three academic years consisting of six semesters for lateral entry students.

ii) Each semester consists of a minimum of ninety instructional days.

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

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

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

vi) Award of division shall be based on the CGPA acquired.

vii) A pool of interdisciplinary, skill development courses, industry internship, socially relevant projects etc., which are relevant to the industry are integrated into the curriculum of the branch of engineering concerned.

viii) As a mandatory rule, all the students shall be registered for the mandatory non-credit courses as per AICTE/UGC/APSCHE guidelines.

6. Attendance Regulations

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

ii) Condoning of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester will be considered for genuine reasons, such as on medical grounds and participation in co-curricular and extra-curricular activities and shall be granted only after the approval by a committee duly appointed by the college. For medical reasons, the student should submit application for medical leave along with medical certificate from a registered medical practitioner within three days from the day of reporting to the classwork after the expiry of the Medical Leave. In the case of participation in co-curricular and extra-curricular activities, either within the college or in other colleges, students must take prior permission in the written form from HoD concerned and should also submit the certificate of participation from the organizers of the event within three days after the completion of the event. Only such cases will be considered for condoning attendance shortage.

iii) A student shall be eligible to claim for condonation of attendance shortage for a maximum of two times during the four year (eight semesters) course work of B.Tech. (Regular) / three year (six semesters) course work of B.Tech. (Lateral).

iv) A student will not be promoted to the next semester unless he satisfies the attendance requirement of the current semester. He may seek re-admission for that semester when offered within 4 weeks from the date of commencement of classwork.

v) Shortage of Attendance below 65% in aggregate shall in *NO* case be condoned.

vi) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end-examinations of current semester and their registration shall stand cancelled.

vii) A fee stipulated by the college shall be payable towards condonation of attendance shortage.

viii) A student is required to put up a minimum of 75% of attendance in the mandatory non-credit courses for getting the satisfactory grade. However, condonation of the shortage of attendance upto 10% shall be applicable for all mandatory non credit courses and a fee stipulated by the college shall be payable towards condonation fee.

7. Distribution and Weightage of marks - Evaluation

The distribution of Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) marks for each course is given in the table:

Sl.No.	Components	Internal	External	Total
1	Theory / Integrated Theory and Laboratory/ Project Based Theory	30	70	100
2	Engineering Graphics/ Design/ Drawing	30	70	100
3	Practical / Skill Development Courses	15	35	50
4	Community Service Project / Internship	-	50	50
5	Project Work	60	140	200
6	Mandatory Non-Credit Courses			
	i) Environmental Studies and Constitution of India	30	70	100
	ii) Sports & Games/ Cultural and NSS/Fine Arts /Yoga /Self Defence	100	-	100

(i) Continuous Internal Evaluation

Theory Courses:

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(OE) consisting of 20 multiple choice questions for 10 marks for a duration of 20 minutes (ii) one descriptive examination(DE) consisting of 3 descriptive questions for 5 marks each a total of 15 marks for a duration of 90 minutes and (iii) one assignment(AT) for 5 marks.

b) First mid-term examination(Mid-I) shall be conducted from first 50% of the syllabus and second mid-term examination(Mid-II) shall be conducted from the rest of the 50% of syllabus.

c) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The final marks of each mid-term examination shall be displayed in the respective department notice boards within 10 days of completion of last examination.

d) Internal marks can be calculated with the sum of the 80% marks of better scored mid-term examination and 20% marks of less scored mid-term examination .

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)

e) *For subjects like Functional English and Professional Communication, the pattern of mid-term examination is given along with the syllabus of the respective subject.*

Integrated Theory and Lab Courses

For the integrated theory and laboratory course, the distribution of 30 marks for internal evaluation shall be, 15 marks for theory based on two descriptive examinations and 15 marks for laboratory. The pattern for the descriptive examination is as same as the pattern for the regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered. Of the 15 marks for the laboratory, 5 marks for the day-to-day performance, 5 marks for record and 5 marks for the semester end internal examination.

Project Based Theory Courses

For the project based theory course, the distribution of 30 marks for internal evaluation shall be, 15 marks for the theory based on two descriptive examinations and 15 marks for project. The pattern for descriptive examination is as same as the pattern for the regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered. 15 marks for project shall be awarded by the department review committee based on the project report and the performance in oral presentation.

Drawing / Design Courses

For the subjects such as Engineering Graphics, Engineering Drawing, Building Planning and Drawing, Estimation, Costing & Valuation, Design & Drawing of Steel Structures etc., the distribution of 30 marks for internal evaluation shall be,

15 marks for day-to-day work, and 15 marks based on two descriptive examinations. The pattern for the descriptive examination is as same as the pattern for regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered.

Practical Courses

For the practical courses the distribution of 15 internal marks shall be, 5 marks for day-to-day performance, 5 marks for record and 5 marks for an internal laboratory test conducted at the end of a semester.

Skill Development Courses

Each student shall register for seven skill development courses (total 10 credits) offered by the department concerned. The distribution of 15 internal marks shall be 10 marks for day-to-day performance, and 5 marks for an internal examination conducted at the end of a semester.

For courses like Logic Building and Basic Coding Principles, Logic Building and Algorithmic Programming and Programming for corporate distribution of 15 internal marks shall be 10 marks for day-to-day performance(these marks will be awarded by taking no. of assignments completed, no. of quizzes attempted and amount of time spent in learning each topic on the LMS prescribed) and 5 marks for an internal laboratory test (internal Lab examination will be conducted on the assessment portal) conducted at the end of a semester.

Project Work

Of the 60 internal marks for a project work, 30 marks shall be awarded by the supervisor based on the student's involvement and 30 marks shall be awarded by the project review committee consisting of a supervisor, a senior faculty member and the HoD concerned based on the performance in Viva-Voce examination at the end of the semester.

Mandatory Non-Credit Courses

a) Each student shall register for four mandatory non-credit courses like Environmental Studies, Constitution of India, Sports & Games/Cultural and NSS/Fine arts/Yoga/Self Defense offered by the respective departments as per the course structure.

b) For courses like Environmental Studies and Constitution of India, two descriptive examinations shall be conducted for 30 marks each along with the mid-term examinations of regular theory courses.

c) Each descriptive examination consists of 3 descriptive questions for 10 marks each with a total of 30 marks for a duration of 90 minutes.

d) Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered.

e) For courses like Sports & Games/Cultural and NSS/Fine arts/Yoga/Self Defense, 100 marks for continuous internal evaluation shall be awarded by the respective class teacher based on the day-to-day participation and performance in the activities organized under each event.

II) Semester End Examinations – Evaluation:

Theory/ Drawing/ Integrated theory and laboratory/ Project based theory Courses

i) For all Theory/Drawing/Integrated theory and laboratory/Project based theory Courses, the semester end examination shall be conducted for 70 marks consisting of five internal choice questions (i.e "either" "or" choice), carrying 14 marks each. There will be two questions from each unit and the student should answer either of the two questions.

ii) There will not be any external assessment for laboratory and project components for integrated theory and laboratory course and project based theory course respectively.

iii) For design courses like Estimating, Costing & Valuation, Design of steel structures, Design of RC structures, Design of Irrigation structures, etc., the pattern for the semester end examination is given along with the syllabus of the respective subject.

iv) *For subjects like Functional English, Professional Communication, etc, the pattern of semester end examination is given along with the syllabus of the respective subject.*

Practical Courses:

The semester end examination shall be conducted for 35 marks by the teacher concerned and an external examiner appointed by the controller of examinations.

Skill Development Courses:

The semester end examination shall be conducted for 35 marks along with the practical examinations in the presence of an external and an internal examiner (course instructor or mentor).

For courses like Logic Building and Basic Coding Principles, Logic Building and Algorithmic Programming and Programming for corporate, semester end examination paper shall consists of 3 sets of questions and student has to choose any one set of Questions. Each set shall have three questions with three levels of complexity and evaluated for a total of 35 marks.

Community Service Project

i) Every student should put in a minimum of **180 hours** for the community service project during the summer vacation.
ii) Each class/section shall be assigned with a mentor.
iii) Departments shall concentrate on their major areas of respective departments concerned. For example, Dept. of Computer Science can take up activities related to computer Literacy to different sections of people like - youth, women, housewives, etc
iv) A log book to record the activities undertaken / involved shall be maintained by every student.
v) The log book has to be countersigned by the mentor concerned.
vi) A report shall be submitted by each student at the end of the semester.
vii) Based on the report and active participation of the student the semester end examination for 100 marks shall be awarded by a committee consisting of a mentor and a senior faculty member of the department.

Internship:

i) 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 specialization of the UG programme.
ii) Students shall pursue this course during summer vacation just before it is offered as per course structure. The minimum duration of this course is at least 6 weeks.
iii) A supervisor shall be allotted to each batch of students to guide and for taking up the summer internship. The supervisor shall monitor the attendance of the students during the internship. Attendance requirements are as per the norms of the college.
iv) After successful completion, students shall submit a summer internship technical report to the department concerned.
v) A certificate from industry / skill development centre shall be included in the report.
vi) Semester end examination for 50 marks shall be conducted by a committee consisting of an external examiner, head of the department and supervisor for the internship. The report and the oral presentation shall carry 40% and 60% weightage respectively.

Project Work:

i) The major project work shall be carried out during the IV year 2nd semester.
ii) The project evaluation and semester end Viva–Voce examination for 140 marks shall be awarded by the committee consisting of an external examiner, head of the department and the supervisor of the project based on the report submitted and performance in Viva-Voce examination.

iii) The evaluation of project work shall be conducted at the end of the fourth year second semester.

Mandatory Non-Credit Courses:

i) For courses like Environmental Studies and Constitution of India, semester end examination shall be conducted by the respective departments internally for 70 marks.

ii) The pattern for examination is same as the regular theory courses.

iii) There is no semester end examination for courses, such as Sports & Games/ Cultural and NSS/Fine arts/Yoga/Self Defense.

Massive Open Online Courses (MOOCs):

i) Each student shall register for one Massive Open Online Course (MOOC) as per the course structure.

ii) A student shall register for MOOC offered by NPTEL, CISCO, MICROSOFT and SAYLOR or any other agency with a prior approval from the departmental committee.

iii) The duration of the course shall be a minimum of 12 weeks.

iv) The Head of the Department shall appoint one mentor for each course.

v) The courses should be other than those offered under regular curriculum and are to be approved by the departmental committee consisting of the head of the department, mentor and one/two senior faculty members before the commencement of each semester.

vi) During the course, the mentor monitors the students' assignment submissions given by the agency.

vii) Students need to submit all the assignments given and need to take final exam at the proctor centre.

viii) The required credits shall be awarded on submission of certificate from the approved agency.

ix) In case if student does not qualify in the chosen subject, the same or an alternative equivalent subject may be registered again in the next semester with the recommendation of the HoD concerned and shall pass.

8. Criteria for Passing a Course, Award of Grades and Award of Division:

i) Criteria for Passing a Course:

a) A candidate shall be declared to have passed in individual theory / integrated theory and laboratory / project based theory / drawing course/design course/ practical/ mini project/main project, if he/she secures a minimum of 40% aggregate marks (continuous internal evaluation & semester end examination marks put together), subject to securing a minimum of 35% marks in the semester end examination.

b) A candidate shall be declared to have passed in skill development courses/ industrial internship/socially relevant project if he/she secures a minimum of 40% marks in the semester end examination.

c) For non-credit mandatory courses, like environmental studies and constitution of India, the student has to secure minimum 40% aggregate marks (continuous internal evaluation & semester end examination marks put together) for passing the course. For courses like Sports & Games/Cultural and NSS/Fine arts/ Yoga/Self Defense, student shall be declared to have passed in the courses if he/she secures a minimum 40% of marks in continuous internal evaluation. No marks or letter grade shall be printed in the grade cards for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified. A student has to repeat the course whenever it is offered; if he does not get satisfactory grade or does not fulfill the attendance requirements in each non-credit course for getting the degree awarded.

d) On passing a course of a program, the student shall earn the credits assigned to that course.

ii) Method of Awarding Letter Grade and Grade Points for a Course:

a) 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.

b) 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.

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Marks Range Theory (Max - 100)	Marks Range Lab (Max. - 50)	Level	Letter Grade	Grade Points
≥ 90	≥ 45	Outstanding	A+	10
≥ 80 & ≤ 89	≥ 40 & 44	Excellent	A	9
≥ 70 & 79	≥ 35 & 39	Very Good	B	8
≥ 60 & 69	≥ 30 & 34	Good	C	7
≥ 50 & 59	≥ 25 & 29	Above Average	D	6
≥ 40 & 49	≥ 20 & 24	Average	E	5
< 40	< 20	Fail	F	0
		Absent	AB	0

iii) Calculation of Semester Grade Point Average (SGPA)* for Semester:

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as given below:

SGPA = $\frac{\sum(CR \; X \; GP)}{\sum CR}$ for each semester.

where CR = Credits of a course
GP = Grade Points awarded for a course

* SGPA is calculated for a candidate who passed all the courses in that semester.

Illustration of SGPA: Let us assume there are 6 subjects in a semester. The grades obtained as follows:

Course	Credits (CR)	Grade Point (GP)	CR x GP
Subject 1	3	8	24
Subject 2	2	9	18
Subject 3	4	7	28
Subject 4	3	6	18
Subject 5	3	9	27
	∑CR=15		**∑CR x GP = 115**

iv) Calculation of Cumulative Grade Point Average (CGPA) for Entire Program:

The CGPA is calculated as given below:

CGPA = $\frac{\sum (CR\ X\ GP)}{\sum CR}$ for entire program.

$SGPA = \frac{\sum CR \times GP}{\sum CR} = \frac{115}{15} = 7.67$ where CR = Credits of a course
GP = Grade points awarded for a course

Illustration of CGPA:

Semester1	Semester2	Semester3	Semester4	Semester5	Semester6	Semester7	Semester8
Credits:15	Credits:22	Credits:24	Credits:22	Credits:23	Credits:21	Credits:20	Credits:20
SGPA:7.67	SGPA:7.86	SGPA:7.87	SGPA:8.67	SGPA:8.78	SGPA:8.50	SGPA:8.60	SGPA:9.00

$$CGPA = \frac{(15x7.67) + (22x7.86) + (24x7.87) + (22x8.67) + (23x8.78) + (21x8.50) + (20x8.60) + (20x9.00)}{(15 + 22 + 24 + 22 + 23 + 21 + 20 + 20)} = 8.38$$

v) Award of Division:

After satisfying the requirements prescribed for the completion of the program, the student shall be eligible for the award of B.Tech. Degree and shall be placed in one of the following grades:

Class of Award	CGPA to be Secured	Remarks
First Class with Distinction	≥ 7.75 (Without any Supplementary Appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 & < 6.75	
Pass Class	≥ 5.00 & < 5.75	

9. Grade Card and Consolidated Grade Card

i) A grade card shall be issued for each semester separately both for regular and supplementary examinations irrespective of passing the examination.

ii) A grade card consists of a letter grade and credits earned for all courses of that semester along with SGPA and CGPA.

iii) A consolidated grade card consisting of all semesters' courses with the letter grade and credits secured for each course, CGPA and award of division shall be issued if he/she fulfills the academic regulations B.Tech. program.

10. Supplementary Examinations

Supplementary examinations will be conducted twice in a year at the end of odd and even semesters.

11. Conditions for Promotion

i) A student shall be eligible for promotion to next Semester of B.Tech. program, if he satisfies the conditions as stipulated in Regulation 6.

ii) The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in Regulation 6 for promotion into III Year I semester and IV year I semester.

a) 4 Year B.Tech Program:

i) A student shall be promoted from II year to III year only if he acquires the academic requirement of a minimum of 40% credits up to second year second semester as shown below.

1.Two regular and two supplementary examinations of I year I semester,

2.Two regular and one supplementary examinations of I year II semester,

3.One regular and one supplementary examinations of II year I semester

4.One regular examination of II year II semester,

irrespective of whether the candidate takes the examination or not.

ii) A student shall be promoted from III year to IV year only if he acquires the academic requirement of a minimum of 40% credits upto third year second semester as shown below.

1. Three Regular and three supplementary examinations of I year I sem.,

2. Three Regular and two supplementary examinations of I year II sem.,

3.Two Regular and two supplementary examinations of II year I semester,

4.Two Regular and one supplementary examinations of II Year II semester,

5.One Regular and one supplementary examinations of III Year I semester,

6.One regular examination of III Year II semester,

irrespective of whether the candidate takes the examination or not.

b) 3 Year B.Tech Program under Lateral Entry Scheme:

i) A student shall be promoted from III to IV year only if he acquires the academic requirement of a minimum of 40% credits up to third year second semester as shown below.

1. Two regular and two supplementary examinations of II year I semester,
2. Two Regular and one supplementary examinations of II year II semester,
3. One regular and one supplementary examinations of III year I semester
4. One regular examination of III year II semester,

irrespective of whether the candidate takes the examination or not.

12. Revaluation

i) Students can apply for revaluation of his/her answer script(s) of theory course(s) as per the notification issued by the Controller of Examinations.

ii) The Controller of Examinations shall arrange for revaluation of such answer script(s).

iii) An examiner, other than the first examiner, shall revaluate the answer script(s).

iv) If the variation in marks of two evaluations is less than 15% of total marks, the best mark of two evaluations shall be taken into consideration.

v) If the variation in marks of two evaluations is more than 15% of total marks, there shall be third evaluation by an examiner other than the first two examiners. The best marks of two evaluations (which are nearer) shall be taken into consideration.

vi) There is no revaluation for practical/ Mini Project/ Skill Development Courses/ Social relevant Project/ Main Project courses.

13. Re-admission Criteria

i) A candidate, who is detained in a semester due to the lack of attendance has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling the required norms stipulated by the college and by paying the required tuition fee and special fee in addition to paying an administrative fee of Rs.1,000/-.

ii) A candidate who is not promoted either to III year or IV year due to lack of required credits can seek admission into III / IV year in subsequent years after obtaining the required credits as stipulated in regulation 11 by paying the required tuition fee & special fee in addition to paying an administrative fee of Rs.1000/-

14. Break in Study

Student, who discontinues the studies for what-so-ever reason, can get readmission into appropriate semester of B.Tech program only with the prior permission of the Principal of the College, provided such candidate shall follow the transitory regulations applicable to the batch he joins. An administrative fee

of Rs.2,000/- per each year of break in study in addition to the prescribed tuition fee and special fees should be paid by the candidate to condone his break in study.

15. Transitory Regulations

When a student is detained due to lack of credits or shortage of attendance, he/she may be readmitted into the same semester in which he/she has been detained. However, the academic regulations under which the detained student was first admitted shall continue to be applicable to him/her.

Transfer candidates (from an Autonomous College affiliated to JNTUK)

A student who has secured the required credits up to previous semesters as per the regulations of other Autonomous Institutions shall only be permitted to be transferred to this college. A student who is transferred from the other Autonomous colleges to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree shall be equal to 160 for regular students and 120 for lateral entry students.

16. Withholding of Results

If the student has not paid the dues, if any, to the College or if any case of indiscipline is pending against him, the result of such student will be withheld. His degree will also be withheld in such cases.

17. Malpractices and Punishments

i) Every student appearing for the Examinations is liable to be charged with committing malpractice(s), if he/she is observed as committing any one or more of the acts mentioned in of examination malpractices and punishments.

ii) The Principal shall refer the cases of malpractices in internal assessment tests and semester end examinations to a malpractice enquiry committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the erring students based on the recommendations of the committee.

iii) Any action by the candidate 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.

DISCIPLINARY ACTION FOR MALPRACTICES/IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices / Improper conduct	Punishment
If the candidate		
1.a	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination.)	Expulsion from the examination hall and cancellation of the performance in that subject only.
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 candidates 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. The hall ticket of the candidate shall be cancelled.

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 the examinations of the remaining subjects of that semester. 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 impostor 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 takes out or arranges to send out the question paper during the examination or answer book during or after the examination.	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. The candidate is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of performance 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 or around the examination hall or organises a walkout or instigates others to walkout 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 of any of his relations or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the Officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
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 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. 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 to appear for the remaining examinations of the subjects of that semester. 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.	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. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and a police case is 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.
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 examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be referred to the Chief Superintendent of Examinations for future action towards suitable punishment.	

iv) Malpractices identified at spot centre during valuation

The involvement of the staff, who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents related 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 appropriate disciplinary action will be taken after thorough enquiry.

18. Other Matters

i) Physically challenged candidates who have availed additional examination time and a scribe during their Intermediate/EAMCET examinations will be given similar concessions on production of relevant proof/documents. Students who are suffering from contagious diseases are not allowed to appear either for internal or semester end examinations.

ii) The students who participated in coaching / tournaments held at State / National / International levels through University / Indian Olympic Association during semester end external examination period will be promoted to subsequent semesters as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated 18-08-1994.

iii) The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Heads of the Departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the Departments shall be reported to the Academic Council for ratification.

18. General

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

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

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

iv) Wherever the word he, him or his occurs, it will also include she, her and hers.

Honors Degree Guidelines

I. Introduction

The goal of introducing B.Tech. (Honors) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research. All the students pursuing regular B.Tech. with prerequisite CGPA are eligible to register Honors degree course. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the B.Tech. Honors degree. The additional courses shall be advanced subjects in the concerned department/discipline. The department concerned will determine required courses for award of Honor degree. The subjects in the Honor degree would be a combination of core (theory and lab) and some electives.

II. Objectives

The objectives of initiating the B.Tech. (Honors) degree certification are:

a) To encourage the under graduates towards higher studies and research
b) To prepare the students to specialize in core Engineering streams
c) To attain the high-level competence in the specialized area of under graduate programme
d) To learn the best educational and professional skills in the specialized area after the completion of his under graduate courses.
e) To provide the opportunity to learn the post graduate level courses in the specified under graduate programme

III. Eligibility

a) The following departments are offering B.Tech. (Honors);
   - Civil Engineering
   - Electrical and Electronics Engineering
   - Mechanical Engineering
   - Electronics and Communication Engineering
   - Computer Science and Engineering

b) B. Tech students (both Regular and Lateral Entry) pursuing a major degree programme can register for Honors degree at their choice in the same department offering major degree from IV semester onwards.

c) Students registering for Honors degree shall select the subjects from same branches/department based on the recommendations of BoS committee. For example, if a student pursuing major degree in Electrical and Electronics Engg. shall the selects subjects in Electrical and Electronics Engg. only and he/she will get major and Honors degree in Electrical and Electronics Engineering.

d) Students registered for honors shall not be permitted to register for B. Tech (Minor).

e) Students who have a CGPA of 8.00 or above, without any backlogs, up to III semester for regular students and only III semester for lateral entry students will be permitted to register for honors degree.

f) CGPA of more than 8.00 has to be maintained in the subsequent semesters of regular degree and also 8.00 GPA has to be maintain in Honors degree to keep the Honor degree registration active.

g) Student registered for Honors degree in a discipline must register and pass in all subjects with a minimum CGPA of 8.0 that constitute requirement for award of Honors degree.

h) The subjects completed under Honors degree programme shall not be considered as equivalent subjects in case the student fails to complete the major degree programme.

IV. Registering for Honor degree

a) Total number of seats offered for a Honors programme shall be a maximum of 35% of sanctioned intake of major degree programme.

b) There is no fee for registration of subjects for Honors degree programme

c) The department offering the honors degree will declare courses offered before the start of the semester.

d) The eligible list of students shall be displayed in the respective department notice board before the start of the semester.

e) The eligible interested students shall submit a registration form to the HoD of concerned department and the department shall maintain the record of students pursing the Honors degree. The process of registration should be completed within one week before the start of every semester.

f) If the student wishes to withdraw, he/she shall inform the same to HoD of concerned department within two weeks after registration of the Honors degree.

V. Attendance Requirements

a) The overall attendance in each semester of regular B. Tech courses and Honors courses shall be computed separately.

b) A student shall maintain an overall attendance of 75% in all registered courses of Honors to be eligible for attending semester end examinations. However, condonation for shortage of attendance up to 10% may be given as per college norms. On the recommendations of College Academic Committee, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee of Rs. 500/-.

c) Student having less than 65% attendance in Honors courses shall not be permitted for end semester examinations.

d) A student detained due to lack of attendance in major B. Tech programme shall not be permitted to continue Honors programme.

e) If a student is detained due to lack of attendance in Honors degree courses, he/she shall not be permitted to continue Honors programme.

VI. Credits requirement

a) Honors degree shall not be awarded at any circumstances without completing the regular major B.Tech. programme in which a student got admitted.

b) A Student will be eligible to get Honors degree along with major degree engineering, if he/she gets an additional 20 credits offered through Honors degree courses.

c) Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses of Honors degree, with four courses(both theory and lab), each carrying 4 credits. The remaining 4 credits must be acquired with two courses through online from platforms like NPTEL, etc., which shall be domain specific, each with 2 credits and with a minimum duration of 12 weeks as recommended by the Board of Studies.

d) Students shall produce a certificate issued by the online platforms like NPTEL, etc. as a proof of credit attainment.

e) Transfer of credits from a particular Honors to regular B.Tech. and Vice-Versa shall not be permitted.

f) If a student fails in any registered course of the Honors degree, he/she shall not be eligible to continue the B.Tech. Honors degree. However, the additional credits and grades thus far earned by the student shall be included in the separate grade card but shall not be considered to calculate the CGPA.

VII. Examinations

a) The examination for the Honors courses offered shall be conducted along with regular B.Tech. programme.

b) The pattern of internal and semester end examinations for Honors degree courses will be similar to regular B.Tech. courses.

c) A separate grade card shall be issued for the Honors subjects passed in each semester.

d) There is no supplementary examination for the failed subjects in a Honors programme.

e) Examination Fee to be paid will be as per the college norms.

Note: ***In the event of any tie during the seat allotment for a Honors degree, the concerned major degree department offering Honors shall conduct a test on the prerequisite subjects of Honors degree and final decision shall be taken.***

Minor Degree Guidelines

I. Introduction

Looking to global scenario, engineering students should have knowledge of subjects from other branches and some advanced subjects of their respective branch in which they are perusing the degree. To complement the same college has decided to take an initiative from 2020-21 in academics by introducing minor degree to the undergraduate students enrolled in the B.Tech. This gives a provision to the students to pursue minor other than the discipline in which student got admitted. An aspiring student can choose the courses and laboratories in any other discipline and can get a minor degree in the chosen specialization in addition to regular major B.Tech. degree. This way undergraduates are not restricted to learn about courses only in the discipline they get admitted to, but can choose courses of their interest to later on take up a career path of their liking. The students taking up a minor degree course will get additional credits. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the minor degree. The department concerned will determine the required courses for award of minor degree. The subjects in minor programme would be a combination of mostly core and some electives.

II. Objectives

The objectives of initiating the minor degree certification are:

a) To diversify the knowledge of the undergraduates.
b) To make the undergraduates more employable.
c) To have more educational and professional skills after the completion of his undergraduate courses.
d) To give a scope to specialize students in other streams of engineering in addition to the ones they are currently pursuing.

III. Eligibility

a) The following departments are offering B.Tech. (Minor);
   - Civil Engineering
   - Electrical and Electronics Engineering
   - Mechanical Engineering
   - Electronics and Communication Engineering
   - Computer Science and Engineering
   - Information Technology

b) The B.Tech. students (both Regular and Lateral Entry) pursuing a major degree programme can register for minor degree at their choice in any other department offering minor from IV semester onwards.

c) Student pursuing major degree in any engineering branch is eligible to register for minor in any other engineering branch. For example, if a student pursuing major degree in Electrical and Electronics Engineering shall complete minor in Civil Engineering and he/she will get major degree of Electrical and Electronics Engineering with minor of Civil Engineering.

d) However, students pursuing major degree in a particular engineering branch are not allowed to register for minor in the same branch.

e) The students are permitted to opt for only a single minor degree in his/her entire tenure of B.Tech. programme.

f) The students registered for minor degree shall not be permitted to register for B.Tech. (Honors.)

g) Students who have a CGPA of 7.75 or above, without any backlogs, up to III semester for regular students and only III semester for lateral entry students will be permitted to register for a minor.

h) CGPA of more than 7.75 has to be maintained in the subsequent semesters of regular degree and also 7.75 GPA has to be maintain in Minor degree to keep the Minor degree registration active.

i) A student registered for minor in a discipline must register and pass in all subjects with a minimum CGPA of 7.75 that constitute requirement for award of minor.

j) The subjects completed under minor degree shall not be considered as equivalent subjects in case the student fails to complete the major degree programme.

IV. Registering for Minor Degree

a) Total number of seats offered for a minor degree programme shall be a maximum of 35% of sanctioned intake of major degree programme.

b) There is no fee for registration of subjects for minor degree programme

c) The department offering the minor will declare courses offered before the start of the semester.

d) The eligible list of students shall be displayed in the respective department notice board before the start of the semester.

e) The eligible interested students shall apply to the HoD offering the minor degree through HoD of his/her parent department and after scrutiny the department offering minor will announce the final list of the selected students for the minor degree.

f) The selected students shall submit a registration form to the HoD offering the minor degree through HoD of his/her parent department. The process of registration should be completed within one week before the start of every semester.

g) Both parent department and department offering minor shall maintain the record of students pursing the minor degree.

h) If the student wishes to withdraw, he/she shall inform the same to HoD of department offering minor degree through HoD of parent department within two weeks after registration of the minor degree.

V. Attendance Requirement

a) The overall attendance in each semester of regular B.Tech. courses and minor courses shall be computed separately.

b) A student shall maintain an overall attendance of 75% in all registered courses of minor degree to be eligible for attending semester end examinations. However, condonation for shortage of attendance up to 10% may be given as per college norms. On the recommendations of College Academic Committee, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee of Rs. 500/-.

c) Student having less than 65% attendance in minor courses shall not be permitted for end semester examinations.

d) A student detained due to lack of attendance in major B.Tech. programme shall not be permitted to continue minor degree programme

e) If a student is detained due to lack of attendance in minor degree courses, he/she shall not be permitted to continue minor programme

VI. Credits requirement

a) Minor degree shall not be awarded at any circumstances without completing the regular major B.Tech programme in which a student got admitted.

b) A Student will be eligible to get minor degree along with major degree engineering, if he/she gets an additional 20 credits offered through minor degree courses.

c) Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses of minor degree, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired with two courses through online platforms like NPTEL, etc., which shall be domain specific, each with 2 credits and with a minimum duration of 12 weeks as recommended by the Board of Studies.

d) Students shall produce a certificate issued by the online platforms like NPTEL, etc. as a proof of credit attainment.

e) Transfer of credits from a minor to regular B.Tech and Vice-Versa shall not be permitted.

f) If a student fails in any registered course of the minor degree, he/she shall not be eligible to continue the B.Tech. minor degree. However, the additional credits and grades thus far earned by the student shall be included in the separate grade card but shall not be considered to calculate the CGPA.

VII. Examinations

a) The examination for the minor courses offered shall be conducted along with regular B.Tech. programme.

b) The pattern of internal and semester end examinations for minor degree courses will be similar to regular B.Tech. courses.

c) A separate grade card shall be issued for the minor degree subjects passed in each semester.

d) There is no supplementary examination for the failed subjects in a minor degree programme.

e) Examination Fee to be paid will be as per the College norms.

Note: ***In the event of any tie during the seat allotment for a Minor degree, the concerned department offering Minor degree shall conduct a test on the prerequisite subjects of Minor degree and final decision shall be taken.***

COURSE STRUCTURE

&

SYLLABUS

COURSE STRUCTURE

I Year - I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	EG3501	Functional English	3	-	-	3
2	MA3501	Linear Algebra and Calculus	3	1	-	4
3	PH3507	Applied Physics	3	-	-	3
4	EE3501	Basic Electrical Engineering	3	-	-	3
5	CT3501	Problem Solving Using C *	3	-	2	4
6	EG3502	Functional English Lab	-	-	2	1
7	PH3508	Engineering Physics Lab	-	-	2	1
		Total	**15**	**1**	**6**	**19**
8	EN3501	Environmental Studies (Mandatory Non-Credit Course)	2	-	-	-

* **Integrated Course with Theory and Laboratory**

I Year - II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	EG503	Professional Communication	2	-	-	2
2	MA3505	Integral Transforms and Vector Calculus	3	1	-	4
3	IN3501	Introduction to Internet of Things	3	-	-	3
4	ME3502	Computer Aided Engineering Drawing*	1	-	4	3
5	UH3501	Universal Human Values 2: Understanding Harmony	2	1	-	3
6	EG3504	Professional Communication Lab	-	-	4	2
7	IN3502	Electronic Workshop for IoT	-	-	4	2
8	EE3503	Basic Electrical Engineering Lab	-	-	4	2
		Total	**11**	**2**	**16**	**21**
9	BA3501	Constitution of India (Mandatory Non-Credit Course)	2	-	-	-

* **Integrated Course with Theory and Laboratory**

L : Lecture T : Tutorial P : Practical

II Year - I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	IN3503	Analog Devices and Circuits	3	-	-	3
2	IN3504	Principles of Communication Systems	3	-	-	3
3	MA3509	Probability and Statistics	2	1	-	3
4	EC3514	Electronic Instrumentation and Measurement Principles	3	-	-	3
5	IN3505	Transducers and Signal Conditioning	3	-	-	3
6	CT3509	Data Structures*	2	-	2	3
7	IN3506	Analog Devices and Ciruits Lab	-	-	2	1
8	EC3515	Analog and Digital Communications Lab	-	-	2	1
9	SD3502	Logic Building and Algorithmic Programming	-	-	2	1
		Total	**16**	**1**	**8**	**21**
10	NS3501	NSS / Fine Arts / Yoga / Self Defense (Mandatory Non-Credit Course)	-	-	2	-

* **Integrated Course with Theory and Laboratory**

II Year - II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	IN3507	Signal Analysis and Processing	2	1	-	3
2	CT3516	Object Oriented Programming through JAVA*	2	-	2	3
3	EC3512	Digital Circuits Design	2	1	-	3
4	IN3508	Computer Organization and Architecture	3	-	-	3
5	MA3508	Numerical Methods and Complex Analysis	2	1	-	3
6		**Open Elective - I**	3	-	-	3
7	EC3523	Digital Circuits Design Lab	-	-	2	1
8	IN3509	Signal Analysis and Processing Lab	-	-	2	1
9	CT3517	Python Programming	-	-	4	2
10	SD3503	Programming for Corporate	-	-	2	1
		Total	**14**	**3**	**12**	**23**
10	SG3501	Sports and Games / Cultural (Mandatory Non-Credit Course)	-	-	2	-

* **Integrated Course with Theory and Laboratory**

L : Lecture T : Tutorial P : Practical

III Year - I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	IN3510	Microprocessrs & Microcontrollers **	2	-	2	3
2	IN3511	Sensors, Actuators and Data Acquisition	3	-	-	3
3	EC3525	Data Communications and Computer Networks	3	-	-	3
4		**Professional Elective - I**	3	-	-	3
5		**Open Elective - II**	3	-	-	3
6	IN3516	Sensors and Actuators Lab	-	-	2	1
7	EC3528	Data Communications and Computer Lab	-	-	2	1
8	EC3529	Microprocessors & Microcontrollers Lab	-	-	2	1
9	SD3505	Competitive Coding	-	-	2	1
10	IN3517	Community Service Project	-	-	8	4
		Total	**14**	**-**	**18**	**23**

III Year - II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	EC3541	Embedded System Design	3	-	-	3
2	CT3541	Artificial Intelligence & Machine Learning	3	-	-	3
3	IN3518	Wireless Sensor Networks for IoT	2	-	-	2
4	EC3542	VLSI System Design	2	-	-	2
5		**Professional Elective - II**	3	-	-	3
6		**Open Elective - III**	3	-	-	3
7	CT3542	Artificial Intelligence & Machine Learning Lab	-	-	2	1
8	IN3522	IoT Based Embedded Systems Lab	-	-	4	2
9	SD3506	Linguistic Competency Building	-	-	2	1
		Total	**16**	**-**	**8**	**20**

** **Project based Theory Course**

L : Lecture T : Tutorial P : Practical

IV Year - I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	BA3503	Engineering Economics & Project Management	2	-	-	2
2	IN3526	Advancements in IoT	3	-	-	3
3	IN3527	Mobile Application Development for IoT	3	-	-	3
4		**Professional Elective - III**	3	-	-	3
5		**Professional Elective - IV**	3	-	-	3
6		**Professional Elective - V**	3	-	-	3
7	IN3531	Mobile Application Development for IoT Lab	-	-	2	1
8	IN3532	ARM Programming for IoT	-	-	4	2
9	IN3533	Internship/ Industrial Training/ Practical Training	-	-	6	3
10	IN3534	MOOCs	-	-	-	2
		Total	**17**	**-**	**12**	**25**

IV Year - II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	IN3535	Major Project	-	-	16	8
		Total	**-**	**-**	**16**	**8**

Open Elective - I

Sl. No.	Course Code	Name of the Course / Laboratory	Department Offering the Subject	No.of Periods per week			No.of Credits
				L	T	P	
1	CE3513	Elements of Civil Engineering (other than CE)	CE	3	-	-	3
2	CE3514	Environment Laws and Policies (other than CE)	CE	3	-	-	3
3	EE3513	Electrical Materials (other than EEE)	EEE	3	-	-	3
4	EE3514	Control Systems Engineering(other than EEE&ECE)	EEE	3	-	-	3
5	ME3517	Automotive Engineering (other than ME)	ME	3	-	-	3
6	ME3518	Elements of Mechanical Transmission (other than ME)	ME	3	-	-	3
7	EC3520	Introduction to Embedded Systems (other than ECE/IoT)	ECE	3	-	-	3
8	EC3521	Fundamentals of Communication Systems (other than ECE/IoT)	ECE	3	-	-	3
9	CS3503	Information Retreival Systems (Other than CSE & AI&DS)	CSE	3	-	-	3
10	CT3522	Computer Graphics (Other than CSE, IT & AI&DS)	CSE	3	-	-	3
11	IT3504	System Software (Other than IT)	IT	3	-	-	3
12	IT3505	Free & Open Source Software (Other than IT)	IT	3	-	-	3
13	MA3516	Fuzzy Mathematics	BS&H	3	-	-	3

Open Elective - II

Sl. No.	Course Code	Name of the Course / Laboratory	Department Offering the Subject	No.of Periods per week			No.of Credits
				L	T	P	
1	CE3524	Remote Sensing & GIS (other than CE)	CE	3	-	-	3
2	CE3525	Green Building Technology (other than CE)	CE	3	-	-	3
3	EE3524	Modeling & Simulation of Engineering Systems (other than EEE)	EEE	3	-	-	3
4	EE3525	Power Systems Engineering (other than EEE)	EEE	3	-	-	3
5	ME3528	Renewable Energy Sources (other than ME)	ME	3	-	-	3
6	ME3529	Venture Development (other than ME)	ME	3	-	-	3
7	EC3535	Automotive Electronics (other than ECE & IoT)	ECE	3	-	-	3
8	EC3536	Introduction to Signal Processing (other than ECE&IoT)	ECE	3	-	-	3
9	CS3504	Network Programming (Other than CSE)	CSE	3	-	-	3
10	CT3529	Social Network Analysis(Other than CSE/CSE(AI&ML))	CSE	3	-	-	3
11	CT3530	Cyber Security (Other than IT)	IT	3	-	-	3
12	IT3508	E-Commerce (Other than IT)	IT	3	-	-	3
13	AD3502	Intelligent Systems (Other than AI&DS)	AI&DS	3	-	-	3
14	CT3531	Recommender Systems(Other than CSE, IT, CSE(AI&ML) & AI&DS)	AI&DS	3	-	-	3
15	IN3514	Introduction to IoT Architecture (Other than IoT)	IoT	3	-	-	3
16	IN3515	Introduction to Smart Sensors (Other than IoT)	IoT	3	-	-	3

Open Elective - III

Sl. No.	Course Code	Name of the Course / Laboratory	Department Offering the Subject	No.of Periods per week			No.of Credits
				L	T	P	
1	CE3538	Basics of Environmental Engineering (other than CE)	CE	3	-	-	3
2	CE3539	Disaster Preparedness, Planning & Management (other than CE)	CE	3	-	-	3
3	EE3535	Principles of Special Electric Machines (other than EEE)	EEE	3	-	-	3
4	EE3536	Electrical Instrumentation (other than EEE)	EEE	3	-	-	3
5	ME3541	Green Engineering (other than ME)	ME	3	-	-	3
6	ME3542	3D Printing Technologies (other than ME)	ME	3	-	-	3
7	EC3548	Assistive Technologies(other than ECE)	ECE	3	-	-	3
8	EC3549	Introduction to Bio-Medical Engineering (other than ECE&IoT)	ECE	3	-	-	3
9	CS3511	DevOps (Other than CSE and IT)	CSE	3	-	-	3
10	CS3512	Object Oriented Analysis & Design (Other than CSE)	CSE	3	-	-	3
11	IT3515	Scripting Languages (Other than IT)	IT	3	-	-	3
12	IT3516	Fundamentals of Software Project Management(Other than CSE&IT)	IT	3	-	-	3
13	AD3505	Web Mining (Other than AI&DS)	AI&DS	3	-	-	3
14	AD3506	AI Chatbots (Other than AI&DS and CSE (AI&ML))	AI&DS	3	-	-	3
15	IN3521	Trends in IoT (Other than IoT)	IoT	3	-	-	3
16	EG3505	Academic Communication	ENG	3	-	-	3

Professional Electives

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1		**Professional Elective - I**	3	-	-	3
	IN3512	i) Introduction to FOG Computing				
	EC3526	ii) Information Theory and Coding				
	EC3527	iii) Digital Signal Processing				
	IN3513	iv) IoT for Agriculture				
2		**Professional Elective - II**	3	-	-	3
	IN3519	i) Wearable Computing				
	CT3543	ii) Soft Computing Techniques				
	EC3543	iii) Digital System Design Using HDL				
	IN3520	iv) Microcontrollers for IoT Prototyping				
3		**Professional Elective - III**	3	-	-	3
	EC3533	i) Bio-Medical Engineering				
	CT3554	ii) Artificial Neural Networks				
	EC3556	iii) Embedded Real Time Operating Systems				
	IN3528	iv) IoT for Industrial Instrumentation				
4		**Professional Elective - IV**	3	-	-	3
	IN3523	i) Cyber Physical Systems				
	CT3555	ii) Cloud Computing				
	CT3545	iii) Data Science				
	IN3529	iv) Analytical IoT Platforms				
5		**Professional Elective - V**	3	-	-	3
	IN3530	i) Smart Sensors				
	EC3557	ii) System-on-Chip Design				
	CT3536	iii) Dataware Housing and Data Mining				
	CT3553	iv) Big Data Analytics				

L : Lecture **T : Tutorial** **P : Practical**

SYLLABUS

FUNCTIONAL ENGLISH
(Common to All Branches)

I Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To equip the students for their present and future academic pursuits involving the following:
  - listening to (and viewing) classroom lectures and other academic presentations with a reasonable degree of accuracy, understanding, and appreciation, and responding to them appropriately;
  - speaking in academic (e.g. classroom discussions) and social contexts with a fair degree of fluency, accuracy and intelligibility, and with due attention to factors such as purpose, audience, context, and culture;
  - reading a wide range of informational and functional texts, including course books and reference materials, from print and non-print sources and using them for a variety of purposes; and
  - writing for academic purposes (e.g. assignments, examination answers) in an organized way following the rules of discourse and using vocabulary and grammar appropriately and accurately; and
- To develop in them the communication strategies and social graces necessary for functioning effectively in social, academic, and other situations in which they may be called upon to use English.

Course Outcomes

Upon successful completion of Functional English, the students will be able to

- speak with a reasonable degree of fluency using communication strategies (i.e. using language appropriately to carry out functions such as greeting, requesting information, seeking confirmation, disagreeing) as well conventions of politeness and courtesy
- speak with a reasonable degree of fluency and accuracy in contexts requiring tasks such as narrating and describing
- listen to short audio and video clips
  - in standard Indian accent with understanding of the types listed in D (1) (a) below; and
  - in native English accent (British and American), especially clips in which the speakers or voice actors speak slowly, and gain both understanding of messages and sensitivity to native-speaker accents
- read fluently comprehending texts of different kinds using multiple strategies to understand explicitly-stated information as well as underlying meanings

- write coherent paragraphs with attention to elements of writing such as content, organization, language, style, and mechanics and the conventions of academic writing
- write survey reports with attention to conventions of report writing
- guard against mistakes Indians typically make in their speech and writing in English

Course Content

UNIT – I:

Listening : Listening Comprehension – Task 1 (IWE - Chapt II)
Speaking : Communication Functions – Conversation between Raghu and Sridhar (IWE - Chapt II)
Reading : Reading Comprehension – Task 1 (DPM)
Vocabulary: (a) GRE Words – 1.1, (b) Collocations – 2.1 (VB)
Grammar : Tenses – Simple Present and Present Continuous (IWE - Chapt II)
Writing : Paragraph-Writing (IWE - Chapt II)

UNIT – II:

Listening : Listening comprehension – Task 2 (WR)
Speaking : Communication Functions – Exercise (DPM)
Reading : Reading Comprehension – Task 2 (DPM)
Vocabulary : (a) Words Often Confused–3.1, (b) One-Word Substitutes–4.1 (VB)
Grammar : (a) Indianism and (b) *Have to* (IWE - Chapt II)
Writing : Paragraph-Writing (IWE - Chapt II)

UNIT – III:

Listening : Listening Comprehension – Task 3 (IWE - Chapt III)
Speaking : Communication Functions – Conversation between Shreya and Kalpana (IWE - Chapt III)
Intensive Reading : Reading Comprehension Task – 3 (DPM)
Extensive Reading : *The Adventures of Huckleberry Finn* by Mark Twain
Vocabulary: (a)Idioms – 5.1, (b) Phrasal Verbs – 6.1 (VB)
Grammar : Tenses – Simple Past and Present Perfect (IWE - Chapt III)
Writing : Paragraph-Writing – Coherence (IWE - Chapt III)

UNIT – IV:

Listening : Listening Comprehension – Task 4 (IWE - Chapt IV)
Speaking : Communication Functions – Conversation between professor and Mayur (IWE - Chapt IV)
Reading : Reading Comprehension – Task 4 (DPM)
Vocabulary: (a) GRE words–1.2, (b) Collocations–2.2, (c) Words Often Confused–3.2(VB)
Grammar : Expressing Futurity (IWE - Chapt IV)
Writing : Clutter-Free Writing (IWE - Chapt IV)

UNIT – V:

Listening : Listening comprehension – Task 5 (WR)

Speaking : (a) Communication Functions and (b) Telephone Etiquette – Exercises (IWE - Chapt IV)

Intensive Reading : Reading Comprehension – Task 5 (DPM)

Extensive Reading : *More Tales from Shakespeare* by Charles and Mary Lamb

Vocabulary: (a) One-Word Substitutes – 4.2, (b) Idioms – 5.2, (c) Phrasal verbs – 6.2 (VB)

Grammar : Structure – *Going to* (IWE - Chapt IV)

Writing : Technical Report Writing (DPM)

- IWE – *Innovate with English* by T Samson (Foundation)
- Chapt – Chapter
- DPM – Department-produced materials (handouts)
- WR – Web-resources
- VB – *Vocabulary Builder for Students of Engineering and Technology* by Vijaya Lakshmi et al (Maruthi)

Text books

1. T. Samson, Innovate with English, First Edn., Cambridge University Press India Pvt. Ltd. under the imprint of Foundation Books, Hyderabad, 2010.
   - Units TWO, THREE and FOUR only
2. M. Vijaya Lakshmi, et al., Vocabulary Builder for Students of Engineering and Technology, Second Edn., Maruthi Publications, Hyderabad, 2017.
3. The following simplified classics, one for each mid-semester, from the series, Great Stories in Easy English, published by S. Chand & Company Limited:
   - The Adventures of Huckleberry Finn by Mark Twain
   - More Tales from Shakespeare
4. Audio and video clips carefully selected by the Department in order to sensitize the students to native-speaker accents
5. Department-produced material on survey report writing

Testing Pattern

First Mid-Term Examination

The paper consists of four questions. All questions are compulsory; there is no choice.

I. Reading an unseen passage and answering two sets of questions on it:

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set. Four of the eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 4 = 4**

II. Twelve contextualized questions of the following from *Vocabulary Builder*: GRE Words: 1.1; Collocations: 2.1; Commonly confused words: 3.1; One-word substitutes: 4.1; Idioms: 5.1; and Phrasal verbs: 6.1 **Marks: 12 x ½ = 6**

III.

a) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Units 2 and 3 of *Innovate with English*) will be given: simple present, present continuous, use of *have to* structure and Indianism **Marks: 8 x ½ = 4**

b) Eight objective-type questions based on one retold classic: *The Adventures of Huckleberry Finn*. **Marks: 8 x ½ = 4**

IV.

a) Completing a conversation (in which informational and interactional functions are performed) with appropriate expressions. **Marks: 8 x ½ = 4**

b) Reading two poorly-written paragraphs and performing the following tasks:

i. Identifying the topic sentence of paragraph (a) and the sentences that do not support the topic sentence, and writing in the answer book the topic sentence and the irrelevant sentences. **Marks: 4 x ½ = 2**

ii. Re-writing paragraph (b), which is poorly organized, into a coherent paragraph choosing appropriate sequence signals or connectives. **Marks: 4 x ½ = 2**

Second Mid-Term Examination

The paper consists of four questions All questions are compulsory; there is no choice.

I.a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.1; Collocations: 2.1; Commonly confused words: 3.1; One- word substitutes: 4.1; Idioms: 5.1; and Phrasal verbs: 6.1 **Marks: 8 x ½ = 4**

b) Analyzing a service encounter – an interaction, either a direct personal one, or over the telephone (e.g. *making enquires at the reception counter in a hotel, an interaction with a salesman at a mall, asking for information on the telephone)* – and

i. identifying the reasons for the failure or breakdown of communication in the conversation **Marks: 4 x ½ = 2**

ii. rewriting the conversation making the communication successful. In the rewritten conversation, the partners in the conversation must sound polite and positive, using the communication strategies listed in the question.**Marks: 4 x ½ = 2**

II. Reading an unseen passage and answering two sets of questions on it:

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 4 = 4**

III.

a) Writing a technical report on the given situation. The report must:
follow the conventions of technical report writing
use language and style appropriate to technical report writing
Marks: 1 x 4 = 4

b) Writing a paragraph of 100 - 150 words on the given topic (e.g. *Should there be a dress code in colleges?*). The paragraph must have:
adequate and relevant ideas on the topic with the ideas properly organized using strategies such as coherence and cohesion;
a topic sentence; and
proper choice of vocabulary and grammatical accuracy. **Marks: 1 x 4 = 4**

IV.

a) Correction of grammatical errors: six sentences with grammatical errors of the following types (dealt with in Unit 4 of *Innovate with English*) will be given: futurity and Indianism. **Marks: 6 x ½ = 3**

b) Six objective-type questions based on one retold classic: *More Tales from Shakespeare.* **Marks: 6 x ½ = 3**

Semester End Examination

Answer any five questions. Question one is compulsory.

I. Reading an unseen (unfamiliar) passage, preferably one taken from a newspaper or a magazine, on a topical event or situation and answering three sets of questions on it:

a. Seven comprehension questions:
- Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set; 'information' questions involving a mere reproduction of the content should be avoided.
- Three of the seven questions should be multiple-choice questions.
- In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 7 x 1 = 7**

b. Finding four one-word substitutes in the passage for the expressions given. **Marks: 4 x ½ = 2**

c. Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 5 = 5**

II. Reading an incomplete conversation that takes place in an academic or social or professional context (where informational and interactional functions are performed) and answering the following questions on it:

a. Completing the conversation with appropriate expressions. The expressions are to be chosen from among the ones given in a box. In the answer book, the examinee is expected to number the blanks as 1, 2, 3, etc., and write against each the expression he/she has chosen. **Marks: 7 x 1 = 7**

b. Writing a dialogue extending the scope of the original conversation following the instructions given in the question on how it should be extended. The instructions must include five communication strategies/functions, and the examinee is expected to use them in his/her dialogue. **Marks: 1 x 7 = 7**

III. Analyzing a service encounter – an interaction, either a direct personal one, or over the telephone, e.g. *making enquiries at the reception counter in a hotel, an interaction with a salesman at a mall, asking for information on the telephone* – and

a. identifying the reasons for the failure or breakdown of communication in the conversation **Marks: 1 x 7 = 7**

b. rewriting the conversation making the communication successful. In the rewritten conversation, the partners in the conversation must sound polite and positive, using the communication strategies listed in the question. **Marks: 1 x 7 = 7**

IV. Reading two badly-written paragraphs and performing the following tasks:

a. Identifying the topic sentence of paragraph (a) and the sentences that do not support the topic sentence, and writing in the answer book the topic sentence and the irrelevant sentences. **Marks: 1 x 7 = 7**

b. Re-writing paragraph (b), which is poorly organized, into a cohesive paragraph choosing appropriate sequence signals. **Marks: 1 x 7 = 7**

V.

a. Writing a paragraph of 150 words on the given topic (e.g. *Should there be a dress code in colleges?*). The paragraph must have:

- adequate and relevant ideas on the topic with the ideas properly organized using strategies such as coherence and cohesion;
- a topic sentence; and
- proper choice of vocabulary and grammatical accuracy. **Marks: 1 x 7 = 7**

b. Writing a survey report using the data on the table(s)/graph(s) given. The report must:

- indicate acquaintance with the conventions of academic writing; and
- the ability to interpret data intelligently.

However, high standards of performance need not be expected as the students are in the first year of their course. It also follows that complex tables/graphs should be avoided. **Marks: 1 x 7 = 7**

VI. Contextualized vocabulary questions with two items on each one of the following from *Vocabulary Builder* (listed as 2 under F. TEXTBOOKS above):

- GRE Words (Units 1.1 and 1.2)
- Collocations (Units 2.1 and 2.2)
- Commonly Confused Words (Units 3.1 and 3.2)
- One-Word Substitutes (Units 4.1 and 4.2)
- Idioms (Units 5.1 and 5.2)
- Phrasal Verbs (Units 6.1 and 6.2)

For example, in the question on idioms, two sentences/contexts with an idiom in each may be given, and the examinee will have to identify the most appropriate meaning of the idiom from among the four options given. **Marks: 14 x 1 = 14**

VII. Correction of grammatical errors:

- Either a conversation with fourteen grammatical errors of the types dealt within the Textbook 1 (*Innovate with English*), or isolated sentences with fourteen grammatical errors will be given.
- The errors will include at least seven typical instances of Indianism widely believed to be inappropriate in standard English.
- If isolated sentences with errors are given, they are not to be given in isolation from their contexts; a conversation with errors of the kind specified above will serve the purpose better.
- The examinees are expected to rewrite the sentences in the answer book, correcting them. **Marks: 14 x 1 = 14**

* * *

LINEAR ALGEBRA AND CALCULUS
(Common to CE, EEE, ME, ECE, IoT, CSE & IT)
I Year – I Semester

Lecture : 3	Tutorial : 1	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To understand the procedure to solve the system of linear equations.
- To know the method for finding eigenvalues and eigenvectors.
- To familiar with the knowledge of differential calculus to support their concurrent and subsequent engineering studies.
- To know how to find maxima and/or minima for a given surface.
- To understand the methods to evaluate areas and volumes using integrals.

Course Outcomes

Upon successful completion of the course, the students will be able to

- solve the system of linear equations in various engineering problems.
- evaluate the eigenvalues and eigenvectors.
- solve linear ordinary differential equations .
- apply the techniques of partial differentiation in optimization problems and solve first order partial differential equations.
- compute areas and volumes using double and triple integrals.

Course Content

UNIT– I: System of Linear Equations

Rank of a matrix – Echelon form, Normal form. System of linear equations – consistency and inconsistency - Gauss-elimination method.

UNIT– II: Eigenvalues and Eigenvectors

Finding eigenvalues and eigenvectors for a given matrix, Properties of Eigenvalues and Eigenvectors, Cayley –Hamilton theorem - finding inverse and powers of a matrix. Singular value decomposition.

UNIT– III: Ordinary Differential Equations

Review on first order ordinary differential equations. Application – Newton's Law of cooling. Solving Second and Higher Order Differential Equations : Homogeneous differential equations and Non-Homogeneous differential equations when RHS terms are of the form e^{ax}, sin ax, cos ax, polynomial in x, $e^{ax}v(x)$ and method of variation of parameters.

Overview of Cauchy's and legendre's differential equations.

UNIT– IV: Partial Differentiation and Equations

Introduction - total derivative, chain rule. Jacobian, Applications - finding maxima and minima (two & three variables).

Solutions of first order linear P.D.E. Solving Non-Linear P.D.E by charpit's method.

UNIT– V: Multi Integrals

Evaluation of double and triple integrals. Areas by double integrals and Volumes by triple integrals. Change the Order of integration.

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, Maitrey Printech Pvt. Ltd, Noida, 2014.
2. B.S.Grewal, Higher Engineering Mathematics, 44th edition, Khanna Publishers, New Delhi, 2020.

Reference Books

1. Schaum's Series, Differential Equations, Tata-Mc Graw Hill Company Limited.
2. Bali & Iyengar,Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd.

* * *

APPLIED PHYSICS

I Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To make the students to learn the physics of sensors and to relate principles of Physics for use in the IOT /engineering applications

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify types of sensors.
- appreciate semiconductor and Thermal Principles for Sensors applications.
- apply fiber optic principles for theoretical and practical purpose.
- explain construction and working of laser.
- discuss various Magnetic principles involved in sensors.

Course Content

UNIT – I: Fundamentals of Sensors

Introduction to Sensors – Transducer – Physical and Chemical Transduction Principles –Property Based Classification – Characterization:-Electrical, Mechanical Thermal and Optical Properties Characterization.

UNIT – II: Semi Conductor and Thermal Sensors

Introduction – Types of Semiconductors – pn Junction Diode – Photo Detectors – Photo Voltaic Effect - Photo Emissive Effect - Photo Diodes, PIN, and Avalanche.

Thermal Detectors – Planck's Black Body Radiation (Qualitative), Bolometer – Seebeck Effect, Peltier Effect, Thermo Couple.

UNIT – III: Fiber Optics Sensors

Introduction – Principle of optical fibers – Type of Optical fibers – Acceptance Angle – Numerical Aperture – Fiber Optic Temperature Sensor – Micro bend Sensors.

UNIT – IV: Laser: Operating Principles and Applications

Introduction – Basic Characteristics – Spontaneous and Stimulated Emission **-** Einstein's coefficient and their relations – Pumping Schemes – Semiconductor laser **–** CO_2 Laser – CO_2 for pollution Monitor, Applications of Laser in Medicine.

UNIT – V: Magnetic Materials

Origin of Magnetism – Classification of magnetic materials – Soft and hard magnetic – Biot – Savart's Law – Ampere's Law – Magnetic Materials as Flux gates, Magnetic regarding.

Text Books

1. Sensors and Transducers, Patranabis D, Prentice Hall India Learning Private Limited.
2. Dr.M.N. Avadhanulu, Dr. P.G. Kshirsagar, Engineering Physics, 9th Edition, S. Chand Publications.

Reference Books

1. Handbook of Modern Sensors, Physics, Designs, and Applications, Jacob Fraden, Springer Cham Heidelberg New York Dordrecht London.
2. Optoelectronics and Optical Fiber Sensors, Prentice Hall India Learning Private Limited, Asit Bran Maity.
3. Semiconductor Optoelectronic Devices, Prentice Hall India Learning Private Limited, Pallab Bhattacharya.

* * *

BASIC ELECTRICAL ENGINEERING

I Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To understand basic laws and theorems of Electrical circuits.
- To familiarize with the constructional details, working principle and characteristics of DC, AC machines

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply various circuit laws to analyze the electrical circuits
- apply network theorems to analyze and design the electrical and electronic circuits
- find the losses and efficiency of AC and DC machines.

Course Content

UNIT – I: Electrical Circuits

Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Series, Parallel circuits and Star-delta and delta-star transformations..

UNIT – II: Methods of Analysis

Source transformation, Network reduction techniques ,Series, parallel, Nodal analysis, mesh analysis, super node and super mesh for D.C excitations.

UNIT – III: Network Theorems

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, compensation theorems for D.C excitations**.**.

UNIT – IV: DC Machines

Principle of operation of DC machines, EMF equation , types of generators-characteristics of DC Generators, DC Motors , types of DC motors, characteristics of DC motors ,losses and efficiency , simple problems.

UNIT – V: AC Machines

Principle of operation of single phase transformer – types – constructional features –EMF equation, equivalent circuit - losses and efficiency of transformer and regulation Principle of operation of three-phase induction motors –slip ring and squirrel cage motors – slip-torque characteristics – efficiency calculation- simple problems.

Text Books

1. William Hayt, Jack E.Kemmerley, “Engineering Circuit Analysis”, 6th Edition, McGraw-Hill Company.
2. N.C.Jagan, C.Lakshmi Narayana, “Network Analysis”, 2nd Edition, BS Publications.
3. P.S.Bimbra, “Electrical Machines”, 2nd Edition, Khanna Publications.
4. J.B.Gupta, “Electrical Machines”, S.K.Kataria and Sons, 2012

Reference Books

1. A. Sudhakar, Shyammohan S Palli, “Electrical Circuits”, 3rd Edition, Tata McGraw- Hill Publications.
2. Alexander, Sadiku “Fundamentals of Electric Circuits” 2nd Edition, McGraw-Hill Company.
3. M.S.Naidu, S.Kamaksiah, “Introduction to Electrical Engineering”, Tata McGraw-Hill Publication Company, 2007.

* * *

PROBLEM SOLVING USING C
(Common to CE, EEE, ME, ECE & IoT)
I Year – I Semester

Lecture : 3	Practice : 2	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To emphasize the use of flowcharts and pseudo code in problem solving.
- To apply C Programmingin problem solving.

Course Outcomes

Upon successful completion of the course, the students will be able to

- outline problem solving steps and solve sample problems.
- use control statements for writing the programs.
- apply the concepts of arrays, strings and pointers in problem solving.
- decompose a problem into functions to develop modular reusable code.
- use structures and files for efficient handling of data.

Course Content

UNIT – I: Problem Solving Steps and Introduction of C

Problem Solving Steps: Understanding problem, developing algorithm, flow chart, coding, debugging and testing.

Introduction of C: General form of a C program, variable declaration, C tokens, basic data types, type conversion, console i/o statements, expressions precedence and associativity, order of evaluation.

Problem Solving: Sample Problems such as evaluating expressions, to calculate area of geometrical shapes.

Programs :

1. Write a C program to calculate the area of triangle using the formula area = $(s(s-a)\ (s-b)(s-c))^{1/2}$ where s= (a+b+c)/2.
2. Write a C Program to find the largest number and smallest among three numbers using ternary operator.

UNIT – II: Control Statements

Selection-Making Decisions – single-way, two-way selection, multi-way selection statements and conditional operator.

Iteration Statements – concept of loops, pre-test and post-test loops in C.

Jump Statements – return, goto, break, exit and continue.

Problem Solving: Calculate the sum of first N numbers, check the given number is prime, and generate Fibonacci series.

Programs :

1. Design and develop a flowchart or an algorithm that takes three coefficients (a, b, and c) of a quadratic equation (ax2+bx+c=0) as input and computes all possible roots. An equation is quadratic only if a is non zero. If a is zero and b is non zero in the above equation then it becomes a linear equation (bx + c = 0).If a and b are zeros then the it becomes a constant equation. Implement a C program for the developed flowchart / algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages.
2. Read two integer operands and one operator form the user, perform the operation and then print the result. (Consider the operators +,-,*, /, % and use Switch Statement)
3. Write a C program to find the sum of n natural numbers and sum of squares of n natural numbers.
4. Read a number from the user input, print all the prime numbers up to that number and print their sum.
5. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print “Correct values”, otherwise print “Wrong values”

UNIT – III: Arrays and Strings

Arrays – Declaring, initializing, accessing and display of one dimensional and two dimensional arrays.

Strings – String Input /Output functions, string manipulation functions.

Problem Solving: Perform addition and multiplication of two matrices, C programs isomg string handling functions.

Programs:

1. Write a C programto search whether the given element is in the array or not.
2. Write a C programto perform addition and multiplication of two matrices.
3. Write a C program to find whether the given string is palindrome or not with and without string handling functions.

UNIT – IV: Pointers and Functions

Pointers – Declaration, Initialization and operations of Pointers.

Functions – General form of functions, categories of functions, types of functions, passing parameters by value and by address, recursive functions, dynamic memory allocation functions, arrays of pointers, pointers and strings.

Problem Solving: Programs on pointer arithmetic’s, Factorial and fibonacci calculation with recursion and without recursion.

Programs:

1. Write a C programto add two numbers using pointers.

2. Write a C programto find the factorial of a given integer using recursive function.
3 Write a C program to exchange (Swap) values of two integers using call by reference.

UNIT – V: Structures and Unions and File Handling

Structures and Unions: Definition, declaration, initialization, accessing members of structures and unions, nested structures, array of structures, array within structures, union within structure.

File Handling: Text and binary files, file operations, file handling functions, random access to files.

Problem Solving: Implement a structure to read and display the Name, date of Birth and salary of an Employee. Programs to access file content.

Programs :

1. Write a C Program using arrays of structures to read the Name, Date of Birth, Five subject marks of N students and display all the details of students along with calculated CGPA of each student.
2. Write a C program to append multiple lines at the end of a text file.
3. Write a C program to count the number of lines, words and characters in a file.

Text Books

1. Programming in C, Pradip Dey, Manas Ghosh, 2nd Edition, Oxford Higher Education.
2. Programming in C, Reema Thareja, 2nd Edition, Oxford Higher Education.

Reference Books

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, Cengage, 2020.
2. Programming in ANSI C, E Balaguruswamy, 7thedition, McGrawHill.
3. Let Us C, Yashvant Kanetkar, 17th Edition, BPB publications.

* * *

FUNCTIONAL ENGLISH LAB
(Common to All Branches)
I Year – I Semester

Practical	: 2	Internal Marks	: 30
Credits	: 1	External Marks	: 70

Course Objectives

- Functional English (Lab) seeks to develop in the students the communication strategies and social graces necessary in order to function effectively in social and other situations in which they may be called upon to speak in English; and
- It seeks to develop in them a greater awareness of English pronunciation and provides for focused practice with the sounds of English and intonation patterns improve their pronunciation skills and to enable them to speak with a reasonable degree of intelligibility.

Course Outcomes

Upon successful completion of Functional English (Lab), the students will be able to

- give short impromptu speeches with confidence and fluency.
- take part in conversations in different functional contexts using English following appropriate communication strategies.
- use conventions of politeness and courtesy in speech and enhance the effectiveness of their communication in English.
- articulate the sounds of English (vowels, consonants, and diphthongs) with accuracy.
- check the pronunciation of words in a dictionary using their knowledge of phonemic symbols.
- pause at appropriate places in their speech in English, enhancing thereby the comprehensibility of their communication.
- speak English with adequate attention to stress, rhythm, and intonation.
- speak without their pronunciation being marred by regional peculiarities, achieving thereby greater intelligibility in their communication with non-Telugu speakers of English.
- read out texts of different kinds fluently with appropriate pauses, stress, and intonation.

Course Content

UNIT – I: a.Greeting, introducing and taking leave b. Pure vowels

UNIT – II: a.Giving information and asking for information b. Diphthongs

UNIT – III: a. Inviting, accepting and declining invitations b. Consonants

UNIT – IV: a. Commands, instructions and requests b. Accent and rhythm

UNIT – V: a. Suggestions and opinions b. Intonation

Text Books

1. Hari Prasad, et al., *Strengthen Your Communication Skills*, First Edn., Maruthi Publications, Hyderabad, 2014.
2. Handouts produced by the Department on "difficult sounds," consonant clusters, the other problems of Telugu learners of English, listening comprehension, and oral reading.
3. The following pieces of software:
   - 'Multimedia Language Lab' provided by K-Van Solution, Hyderabad
   - 'Foundation Course in Communication Skills' provided by the Andhra Pradesh State Council of Higher Education (APSCHE), Government of Andhra Pradesh.
4. Audio and video clips such as 'BBC English'

Testing Pattern

I. Internal **30 marks**

a. Regular performance in the Language/Communications Lab 15 marks

b. Completing the tasks in the lab manual 05 marks

c. Testing of listening : Listening to a short audio clip of a speech/conversation in British accent and answering questions at the 'information' level. 05 marks

d. Test of reading: Role-playing a dialogue with proper pronunciation and with reasonable attention to tone groups, stress, rhythm and intonation. 05 marks

II. External **70 marks**

a. Test of writing

Writing a dialogue on the situation set 10 marks

Answering 'Yes/No' questions on pronunciation 05 marks

Marking sentence stress and intonation 05 marks

Writing English word for the word in phonetic transcription 05 marks

b. Test of speaking 25 marks

Role-playing a situational dialogue (e.g. 'At the railway station,' 'At the restaurant') with proper pronunciation and with reasonable attention to tone groups, stress, rhythm, and intonation

c. Viva voce (with an external examiner) 20 marks

Speaking for one minute on a given topic

* * *

ENGINEERING PHYSICS LAB

I Year – I Semester

Practical	: 2	Internal Marks	: 30
Credits	: 1	External Marks	: 70

Course Objectives

- To draw the relevance between the theoretical knowledge and to imply it in a practical manner.
- Understand the behavior and characteristics of various active and passive components and sensors.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify Dielectric constant of a semiconductor.
- draw characteristic curves to estimate thermal coefficient of a thermsitor.
- estimate Magnetic Field of a current carrying coil.
- identify beam divergence and bending losses.
- utilize motion, thermal sensors for respective applications

List of Experiments

1. Determine the heat sensitivity of the skin.
2. Peltier Effect – determination of thermo emf of a thermo couple.
3. Determine amplitude of a simple pendulum with motion sensor.
4. Measurement of beam divergence in Laser.
5. Determination of bending losses in optical fiber.
6. Building a piezoelectric Generator.
7. Determine the dielectric constant of capacitor.
8. Determination of thermal resistance of thermistor.
9. Determine the magnetic field along the axis of a circular coil along the axis of a circular coil carrying current-Steewart and Gee's Experiment.
10. Determination of numerical aperture of an optical fiber.
11. Illustrate the Voltage regulatory nature of Zener diode.
12. Determination of wave length of source using diffraction grating.
13. Characterize the temperature sensor (RTD).
14. Simulate the performance of a bio-sensor.

15. Measurement of level in a tank using capacitive type level probe
16. Design an orifice plate for a typical application
17. Simulate the performance of a chemical sensor
18. Characterize the strain gauge sensor

Note: Any 08 Experiments and 2 Virtual Lab Experiments out of 15

Reference Books

1. Vijay Kumar & T. Radha Krishna, Practical Physics for engineering students.
2. Dr. Y.Aparna and Dr. K.Venkateswara Rao, Lab manual of Engineering Physics, VGS Books links, Vijayawada.
3. R.Jayaraman,V.Umadevi,S.Maruthamuthu,B.Saravana Kumar, Engineering Physics laboratory manual(1st edition) Pearson publishers.

* * *

ENVIRONMENTAL STUDIES
(Common to CE, ME, IoT & IT)
I Year – I Semester

Lecture	: 2	Internal Marks	: 30
Credits	: -	External Marks	: 70

Course Objectives

- To impart the basic knowledge about the environment and ecology.
- To develop an attitude of concern for biodiversity and its conservation.
- To create awareness on environmental pollution and waste management.

Course Outcomes

Upon successful completion of the course, the students will be able to

- create awareness among the people in protection of environment.
- analyze structure and functional attributes of an ecosystem.
- explain the values of biodiversity.
- identify the sources of environmental pollution, assess their effects and suggest suitable control measures.
- adopt sustainable waste management practices.

Course Content

UNIT – I: Multidisciplinary Nature of Environmental Studies

Definition – Scope – Importance - Need for Public Awareness – Multidisciplinary nature of Environmental Studies – Role of a citizen in protection of environment

UNIT – II: Ecosystem

Concept of an ecosystem – Structural features of an ecosystem – Functional attributes of an ecosystem: Trophic structure – Food Chains – Food Web – Ecological Pyramids – Energy Flow– Biogeochemical Cycles – Ecological Succession.

UNIT – III: Biodiversity & Its Conservation

Definition – Levels of Biodiversity – Bio-geographical zones of India – Values of biodiversity (Consumptive use value, Productive use value, Social value, Ethical value, Aesthetic value, Option values, Ecosystem service values) – India as a mega diversity nation–Hot spots of biodiversity-Threats to biodiversity – Endangered &Endemic species of India – Conservation of biodiversity.

UNIT – IV: Environmental Pollution

Definition, causes, effects & control measures of : Air pollution – Water pollution – Noise pollution-Soil pollution. Global climatic issues: IPCC- Introduction – Role of IPCC-Global warming – Acid rains – Ozone layer depletion.

UNIT – V: Waste Management

Waste water treatment – Municipal solid waste management – Biomedical waste management – Hazardous waste management – E-waste management – Environmental legislations: Wild life (Protection) Act,1972 – Water (Prevention and Control of Pollution) Act, 1974 –Forest (Conservation) Act,1980 – Air (Prevention and Control of Pollution) Act, 1981 – Environmental(Protection) Act,1986.

Text Books

1. Anubha Kaushik, C.P.Kaushik, Environmental Studies, Fourth Edition, New Age International Publishers.
2. P.Anandan, R.Kumaravelan, Environmental Science & Engineering, Scitech Publications (INDIA) Pvt. Ltd.

Reference Books

1. Shashi Chawala, Environmental Studies, Tata McGraw Hill Education Private Limited.
2. Deeksha Dave & P. Udaya Bhaskar, Environmental Studies, Cengage Learning.
3. Dr.Suresh, K.Dhameja, Society and Environment, S.K. Kataria & Sons.
4. Benny Joseph, Environmental studies, Tata McGraw Hill Publishing Company Limited.

* * *

PROFESSIONAL COMMUNICATION
(Common to All Branches)
I Year – II Semester

Lecture	: 2	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

- To equip the students with common employability skills (the skills required for gaining employment and performing successfully in different careers) which can enable them to perform communication tasks of increasing length and complexity.
- To develop in them the interactional communication strategies and social graces which have the potential to add to the effectiveness of professional communication.

Course Outcomes

Upon successful completion of Professional Communication, the students will be able to

- speak with a reasonable degree of fluency and accuracy in professional communication situations (such as arriving at a consensus through discussion, making a presentation, and taking part in a telephone conversation)
- add to the effectiveness of their oral communication by using communication strategies, conventions of politeness and courtesy, and stress and intonation.
- listen to short audio and video clips in native English accent (British and American), and gain both understanding of messages and sensitivity to native-speaker accents
- read fluently, comprehending texts of different kinds using multiple strategies and higher-order skills
- produce written discourses of different kinds (e.g. texts expressing opinions and making a convincing case for one's standpoint, professional emails, and summaries of lengthy texts) with attention to elements of writing such as content, organization, language, style, and mechanics
- guard against grammatical errors Indians typically make in their speech and writing in English

Course Content

UNIT – I:

Listening : Listening comprehension – Task 1 (IWE – Chapt VII)
Speaking : Communication Strategies: Conversation Amith& Mahesh (IWE – Chap VII)
Reading : Reading Comprehension – Task 1 (IWE – Chapt VII)
Vocabulary: (a) GRE words – 1.3, (b) Collocations – 2.3 (VB)
Grammar : *If* Clause (IWE – Chapt VII)
Writing : Email writing (IWE – Chapt VII)

UNIT – II:

Listening : Listening comprehension – Task 2 (WR)
Speaking : Exercise on Communication Strategies (IWE – Chapt VII)
Reading : Reading Comprehension – Task 2 (DPM)
Vocabulary: Words often confused – 3.3, One-word substitutes – 4.3 (VB)
Grammar : Modal verbs (IWE – Chap VII)
Writing : Email writing and Argumentative Essay (IWE – Chapt VII)

UNIT – III:

Listening : Listening comprehension – Task 3 (WR)
Speaking : Communication Strategies – Exercise (DPM)
Intensive Reading : Reading Comprehension – Task 3 (DPM)
Extensive Reading: *Pride and Prejudice* by Jane Austen
Vocabulary: (a) Idioms – 5.3, (b) Phrasal verbs – 6.3 (VB)
Grammar : Indianism (IWE – Chapt VII)
Writing : Argumentative Essay (DPM)

UNIT – IV:

Listening : Listening comprehension – Task 4 (IWE – Chapt VIII)
Speaking : Communication Strategies and Presentation: Conversation between Suchitra, Lakshmi, Guhan and Karan ((IWE – Chapt VIII)
Reading : Reading Comprehension – Task 4 (DPM)
Vocabulary: (a) GRE Words – 1.4, (b) Collocations – 2.4, (c) Words Often Confused – 3.4 (VB)
Grammar : Indefinite Articles (IWE – Chapt VIII)
Writing : Presentation – Analysis (DPM)

UNIT – V:

Listening : Listening comprehension – Task 5 (WR)
Speaking : Communication Strategies – Exercise (IWE – Chapt VIII)
Intensive Reading : Reading Comprehension Task – 5 (DPM)
Extensive Reading : *Gulliver's Travels* by Jonathan Swift
Vocabulary: (a) One-Word Substitutes – 4.4, (b) Idioms – 5.4, (c) Phrasal-verbs – 6.4 (VB)
Grammar : Definite Articles (IWE – Chapt VIII)
Writing : Presentation – Rewriting

- IWE – *Innovate with English* by T Samson (Foundation)
- Chapt - Chapter
- DPM – Department-produced materials (handouts)
- WR – Web-resources
- VB– *Vocabulary Builder for Students of Engineering and Technology* by Vijaya Lakshmi et al (Maruthi)

Textbooks

1. T. Samson, *Innovate with English*, First Edn., Cambridge University Press India Pvt. Ltd. under the imprint of Foundation Books, Hyderabad, 2010.
   - Unit SEVEN and EIGHT only
2. M. Vijaya Lakshmi, et al., *Vocabulary Builder for Students of Engineering and Technology, Second Edn.,* Maruthi Publications, Hyderabad, 2017.
3. The following simplified classics, one for each mid-semester, from the series, *Great Stories in Easy English*, published by S. Chand & Company Limited:
   - *Pride and Prejudice* by Jane Austen
   - *Gulliver's Travels* by Jonathan Swift
4. Audio and video clips carefully selected by the Department in order to sensitize the students to native-speaker accents.
5. Department-produced materials on reading comprehension.

Testing Pattern

First Mid-Term Examination

The paper consists of four questions. All questions are compulsory; there is no choice.

I. Reading an unseen passage and answering two sets of questions on it:

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 100 – 150 words. **Marks: 1 x 4 = 4**

II. Reading a poorly-written e-mail message and doing the following tasks:

a) Analyzing the reasons for the e-mail failing to meet the standards of professional e-mail communication. The analysis must identify and discuss at least five reasons. (Length: 100 – 150 words) **Marks: 1 x 3 = 3**

b) Rewriting the e-mail using the standards of professional e-mail communication. **Marks: 1 x 3 = 3**

III.

a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.3; Collocations: 2.3; Commonly confused words: 3.3; One- word substitutes: 4.3; Idioms: 5.3; and Phrasal verbs: 6.3 **Marks: 8 x ½ = 4**

b) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Unit 7 of *Innovate with English*) will be given: *if*-clause and Indianism **Marks: 8 x ½ = 4**

IV.

a) Completing a conversation (where informational and interactional functions are performed) with suitable expressions. **Marks: 8 x ½ = 4**

b) Answering eight 'true-or-false' questions on communication strategies and functions given in form of short dialogues. **Marks: 8 x ½ = 4**

Second Mid-Term Examination

The paper consists of four questions. All questions are compulsory; there is no choice.

I. Reading a poorly-written e-mail message and doing the following

a) Analyzing the reasons for the e-mail failing to meet the standards of professional e-mail communication. The analysis must identify and discuss at least five reasons. (Length: 100 – 150 words) **Marks: 1 x 4 = 4**

b) Rewriting the e-mail using the standards of professional e-mail communication **Marks: 1 x 4 = 4**

II. Reading an unseen passage and answering two sets of questions on it.

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks 8 x ½ = 4**

b) Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 100 – 150 words. **Marks: 1 x 4 = 4**

III.

a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.4; Collocations: 2.4; Commonly confused words: 3.4; One- word substitutes: 4.4; Idioms: 5.4; and Phrasal verbs: 6.4 **Marks: 8 x ½ = 4**

b) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Unit 8 of *Innovate with English*) will be given: articles and Indianism. **Marks: 8 x ½ = 4**

IV. Reading an expository text and doing two tasks:

a) Making notes (identifying the main points of the text and writing them down in note form) **Marks: 1 x 3 = 3**

b) Summarizing the text using the notes already made **Marks: 1 x 3 = 3**

Semester End Examination

Answer any five questions: **Question I is compulsory.**

I. Reading a poorly-writen e-mail message and doing the following task: (Compulsory)

a. Analyzing the reasons for the email failing to meet the standards of professional email communication. The analysis must identify and discuss at least seven reasons. (Length: 100-150 words) **Marks: 1 x 7 = 7**

b. rewriting the email using the standards of professional email communication. **Marks: 1 x 7 = 7**

II. Reading the text of a presentation made in a professional context and answering the following questions:

a. Analysing the passage from the point of view of language and style and identifying the reasons for the presentation falling short of the standards of professional presentations (Length of the answer: 100 – 150 words) **Marks: 1 x 7 = 7**

b. Rewriting the text of the presentation in the light of the analysis made in (a) above and following the conventions of professional presentations as far as language and style are concerned. **Marks: 1 x 7 = 7**

III. Reading an unseen (unfamiliar) passage on an issue related to engineering and technology or on a professional issue or situation and answering two sets of questions on it:

a. Seven comprehension questions: **Marks: 7 x 1 = 7**

- Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, pinpointing the writer's attitude/bias, etc. are to be set; 'information' questions involving a *mere* reproduction of the content should be avoided.
- At least three of the seven questions should be multiple-choice questions.
- In case of non-multiple-choice questions, the length of each answer should not exceed 50 words.

b. Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 200 – 250 words. **Marks: 1 x 7 = 7**

IV. Filling in blanks in sentences using GRE words, collocations, one-word substitutes, commonly-confused words, idioms, and phrasal verbs. The contexts will be clearly given for each expression, and the questions will be multiple-choice ones. **Marks: 14 x 1 = 14**

- GRE Words (Units 1.3 and 1.4)
- Collocations (Units 2.3 and 2.4)
- Commonly Confused Words (Units 3.3 and 3.4)
- One-Word Substitutes (Units 4.3 and 4.4)
- Idioms (5.3 and 5.4)
- Phrasal Verbs (Units 6.3 and 6.4)

V. Reading a on a professional or semi-professional issue and answering two questions on it:

a. Matching suitable expressions selected from the dialogue with the given communication strategies. **Marks: 7 x 1 = 7**

b. Extending the scope of the dialogue using at least five of the given communication strategies/functions. **Marks: 1 x 7 = 7**

VI. Correction of grammatical errors:

- Either a conversation with twelve grammatical errors (in the areas of articles, modal verbs, prepositions, phrasal verbs, and Indianism), or isolated sentences with twelve grammatical errors will be given.
- If isolated sentences with errors are given, they are not to be given in isolation from their contexts; a conversation with errors of the kind specified above will serve the purpose better.

The examinees are expected to rewrite the sentences in the answer book, correcting hem. **Marks: 14 x 1 = 14**

VII. Reading an expository text and doing two tasks:

a. Making notes (identifying the main points of the text and writing them down in note form) **Marks: 6 x 1 = 6**

b. Summarizing the text using the notes already made. **Marks: 1 x 8 = 8**

* * *

INTEGRAL TRANSFORMS AND VECTOR CALCULUS
(Common to All Branches)

I Year – II Semester

Lecture : 3	Tutorial : 1	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To gain the knowledge of Laplace and inverse transforms.
- To understand the concepts of Fourier series and Fourier Transforms.
- To know about vector differentiation and integration.

Course Outcomes

Upon successful completion of the course, the students will be able to

- evaluate improper integrals using Laplace transforms.
- apply Laplace transforms to find the solutions of initial and boundary value problems.
- find the Fourier series representation of a function in one variable and apply Fourier transform in various engineering problems.
- apply the concepts of vector differentiation in their engineering fields.
- verify the relation between line, surface and volume integrals using integral theorems.

Course Content

UNIT – I: Laplace Transforms

Laplace transforms of standard functions – Shifting Theorems - Multiplication and division by t, transforms of derivatives and Evaluation of Improper Integrals - Unit step function – Dirac Delta function.

UNIT – II: Inverse Laplace Transforms

Inverse Laplace transforms – by partial fractions –Convolution theorem (without proof).

Application: Solution of Initial value problems and Boundary value problems.

UNIT – III: Fourier Series and Fourier Transforms

Fourier Series: Fourier series in an arbitrary interval, Half-range sine and cosine series.

Fourier integral theorem (only statement). Fourier transforms and inverse Fourier transforms, Fourier sine and cosine transforms and inverses. Properties of Fourier transforms.

UNIT – IV: Vector Differentiation

Gradient – unit normal – angle between surfaces – directional derivative . Divergence – solenoidal vector. Curl – irrotational vector – scalar potential. Laplacian operator.

UNIT – V: Vector Integral theorems

Greens theorem , Stokes theorem and Gauss Divergence Theorem - related problems. Applications: Work done, flux across the surface.

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, Maitrey Printech Pvt. Ltd, Noida, 2014.
2. B.S. Grewal, Higher Engineering Mathematics, 44th edition, Khanna Publishers, New Delhi, 2020.

Reference Books

1. Schaum's Series, Differential Equtions, Tata-Mc Graw Hill Company Limited.
2. Bali & Iyengar,Text Book of Engineering Mathemtics, Laxmi Publications (P) Ltd.

* * *

INTRODUCTION TO INTERNET OF THINGS

I Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the basic characteristics and different technologies with the IoT.
- To familiarize with architectures, enabling technologies and design methodologies of IoT.
- To familiarize with python programming.

Course Outcomes

Upon successful completion of the course, the students will be able to

- understand the design methodologies of IoT.
- differentiate IoT and M2M.
- know the different technologies used in IoT.
- describe the case studies on IoT.
- learn the python programming concepts.

Course Content

UNIT – I: Internet of Things Concepts

Introduction to Internet of Things,Block diagram of IoT, characteristics of IoT, Industrial evolution, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT levels, Development Templates..

UNIT – II: IoT and M2M Technologies

M2M, Differences between IoT and M2M, SDN and NFV for IoT, Software defined Networking, Network Function Virtualization, Developing Internet of Things: Introduction, IoT Design Methodology..

UNIT – III: IoT Technologies

Basic building blocks of IoT, Introduction to cloud storage models, Role of Machine learning, Artificial Intelligence and Data Science in IoT, Categories of ML, Applications of ML, Tools in ML, Requirement of Data analytics in IoT.

UNIT – IV: Python Programming

Introduction to python, Python data types and data structures, ,data manipulation, control flow, functions, python packages.

UNIT – V: Case Studies Case studies on Domain specific IoT's, Home Automation, cities, environment, Agriculture and health monitoring and energy, Health and fitness monitoring.

Text Books

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On-Approach”, Arshdeep & Vijay Madisetti Publishers, 2014. [Units:I,II,IV,V]
2. V.K.Jain, “Data science and Analytics”, Khanna Publishing, 2018. [unit:III]

Reference Books

1. Vlasios Tsiatsis Stamatis Karnouskos Jan Holler David Boyle Catherine Mulligan, “Internet of Things”, Academic Press, 2018.
2. Daniel Kellmereit, “The Silent Intelligence: The Internet of Things”, Lightning Source Inc., 2014.

* * *

COMPUTER AIDED ENGINEERING DRAWING

I Year – II Semester

Lecture : 1	Practical : 4	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To introduce the concepts of drawing 3-D objects in 2-D planes and to impart computer aided drafting skills.

Course Outcomes

Upon successful completion of the course, the students will be able to

- construct polygons and conic sections.
- draw projections of points , lines ,planes and solids in different positions.
- draw orthographic from isometric views of different parts.
- create engineering drawings using drafting package.

Course Content

UNIT – I: Geometrical Constructions, Conics and Orthographic Projections

Geometrical Constructions: Bisecting a line and arc, division of a circle, construction of polygons

Conics: Construction of ellipse, parabola, hyperbola using general method

Orthographic Projections: Principles of orthographic projections, projections of points in various quadrants.

Practice of basic drawing and editing commands using CAD Package.

UNIT – II: Projections of Straight Lines

Lines parallel to both planes, parallel to one and inclined to other plane, straight lines inclined to both planes

Drawing of projections of straight lines using CAD Package.

UNIT – III: Projections of Planes

Regular planes perpendicular / parallel to one reference plane and inclined to other reference plane, planes inclined to both the reference planes.

Drawing of projections of planes using CAD Package.

UNIT – IV: Projections of Solids

Regular solids with axis perpendicular to one reference plane, solids with axis inclined to one reference plane and perpendicular to other reference plane.

Drawing of projections of solids using CAD Package.

UNIT – V: Isometric Views

Conversion of isometric views to orthographic views and vice versa.

Drawing of orthographic views and isometric views using CAD Package.

Text Books

1. N.D. Bhatt, "Engineering Drawing", 53rd Edition, Chariot Publications.
2. K.VenuGopal, V. Prabhu Raja, "Engineering Drawing with AutoCAD, 5th Edition, New Age International Publishers.

Reference Books

1. B.V.R.Gupta and M.Raja Roy, "Engineering Drawing with AutoCAD", 3rd Edition, I.K. Publishers
2. Dhanunjay A Jolhe, "Engineering Drawing", 2nd Edition, McGraw-Hill Education.
3. S.N.Lal, "Engineering Drawing with AutoCAD", 3rd Edition, Cengage Publishers.

* * *

UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY
(Common to CE, ME, IoT & IT)

I Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To help students understand the need, basic guidelines, content and process of value education.
- To help students initiate a process of dialog with in themselves to know what they really want to be in their life and profession.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
- To understand the harmony in nature and existence.
- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Course Outcomes

Upon successful completion of the course, the students will be able to

- be aware of themselves and surroundings
- be responsible in life
- develop personality to be happy continuously and prosper
- handle the problems with sustainable solutions.
- possess human nature in mind
- apply what they have learnt to their own self in real life situations

Course Content

UNIT – I : Value Education

Significance of Universal human values, Value Education – Importance, content, Process. Self-exploration, Basic human aspirations, Right understanding, Natural acceptance.

Suggested topics for Tutorial/Practice sessions:

Learning HVLS from the Inspiring Life Sketches of great personalities:

Isaac Newton, Michael Faraday, JJ Thomson, Einstein, Madam Curie, Mahatma Gandhi, Abraham Lincoln, JF Kennedy, Martin Luther King, BR Ambedkar, Charles Darwin, Karl Marx, Helen Keller, Sam Pitroda, Mark Zuckerberg, SudhaMurty, Leonardo Davincy, Michelangelo, The eternal 3: Socrates, Plato, Aristotle, Alexander, Swami Vivekananda, Abdul Kalam, AB Vajapayee, Sergei Bubka.

UNIT – II: Harmony In Myself

Co-existence of the self and the Body, Understanding the needs of Self (I') and Body'-Sukh and Suvidha, Body as an instrument of 'I', Harmony in 'I' - Sanyam and Svasthya, correct appraisal of our Physical needs.

Suggested topics for Tutorial/Practice sessions:

Leadership through Literature: ValmikiRamayan, Vyasa MahaBharath- Bhagavad Gita, Answers of Yudhistir to Questions by Yaksha, Kaalidas- Raghu Vamsam, Abhignyana Saakuntalam and Maalavika Agnimitram, Homer- Iliad and Odyssey, Professionalism- Learning from the Jews, Buddha, The Bible- Jesus Christ, Solomon's wisdom, The Koran- Prophet Mohammad, Guru Nanak, John Milton, Shakespeare, Sigmond Freud, Robin Sharma, Ravindranath Tagore, Sadguru Jaggi Vasudev, War and Peace by Leo Tolstoy, Unto the Last by Ruskin, Social Contracts by Rousseu, If by Rudyard Kipling, The 7 Habits of highly effective people by Stephen R Covey. Art of Rhetoric by Aristotle.

UNIT – III: Harmony in the Family and Society

Family as the basic unit of human interaction, Harmony in the family, Justice, Trust, Respect, Intention vs competence, Respect is Differentiation.Extending relationship from family to society.Comprehensive human goal – identification, programs for achievement of the goal.Dimensions of Human endeavour, Harmony from family order to world family order.

Suggested topics for Tutorial/Practice sessions:

Ideal Home: Characteristics of Happy families, Personal hygiene and habits, Harmony, Health and happiness, Advantages of combined families.Vasudhaika Kutumbam- Universalism.Vilasa Vidya- Importance of hobbies, Music therapy. Influence of friends and peer groups- ideal friend, Friendship and faith, Avoiding vices, Advance Crime detection technologies, Law and legislation pertaining to students.

UNIT – IV: Harmony in the Nature and Existence

Harmony in the nature – orders in nature, existence as co-existence, co-existence of units in space, holistic perception of harmony at all levels of existence.

Suggested topics for Tutorial/Practice sessions:

Leadership through languages: Atleast 5 poems / rhymes and 10 Sentences of each among atleast 10 of the following languages: Sanskrit, Telugu, Tamil, Malayalam, Kannada, Oriya, Bengali, Hindi, Urdu, Punjabi, Maratthi, Gujarati, Latin, Greek, Chinese, Japanese, Italian, Spanish, French and German. Bionics: Technology from animals. Interpretation of Paintings.

UNIT – V: Implications of the Right Understanding

Values in different dimensions of Human living,definitiveness of ethical human conduct,development of Human consciousness ,implications of value based living. Identification of comprehensive Human goal, Humanistic Education,

humanistic constitution,humanistic universal order and its implications. Competence in professional Ethics, Holistic technologies and systems.

Suggested topics for Tutorial/Practice sessions:

Personality Traits: Ich Bin- Who am I? Know thyself. Self esteem, Sanyam: Self learning, self motivation, self control and self discipline, Thinking aloud, Team work, Discipline, Courage, Creativity, Sense of humour, Equanimity- love for animals and nature, Gratitude, Time and money management, Leadership skills, Importance of sports and games, Importance of Swimming, Writing and Public speaking skills, Quotable quotations: Those who quote only are quoted. Mpemba Effect – The Rags to riches concept. Commonalities of great personalities. Estimation of value of a person and his habits. SWOT Analysis.

Text Books

1. R.R Gaur, R.Sangal and G.P.Bagaria; "A Foundation Course in Human Values and Professional Ethics", 2011, Excel Books, New Delhi.

Reference Books

1. A N Tripathy, 2003, Human Values, New Age International Publishers.
2. KVSG Murali Krishna, Mastering LIFE SKILLS ,Environmental Protection Society, Kakinada, 2015.
3. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Note: Tutorial/Practice sessions may be conducted with reference to Many Historical aspects, having relevance to the topic of discussion. Few of such topics are suggested.

Methodology Suggested for Instruction:

- Teacher is a mentor or guide or Supervisor
- Student –Teacher interactive sessions in the class.
- Student must be made to think and express his views boldly.
- Every student has to present individual PPT about the content of the subject
- Assignments need to be submitted by students and evaluated by teacher into dedication specifying critical review.

* * *

PROFESSIONAL COMMUNICATION LAB
(Common to All Branches)

I Year – II Semester

Practical	: 4	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

- Professional Communication (Lab) is a career-oriented programme. It seeks to develop in the students the competence required to perform professional communication tasks of increasing length and complexity, which can help them secure employment and perform successfully in their careers.

Course Outcomes

Upon successful completion of Professional Communication Lab, the students will be able to

- enhance the effectiveness of their communication through body language;
- take part in interactional communication (i.e. communication that serves the purpose of social interaction or small talk) with fluency
- take part in transactional communication (i.e. communication that serves the purpose of carrying out functions such as giving directions, complaining, and apologizing) with fluency
- speak professionally in telephone conversations;
- make effective presentations using a range of strategies, including a good organization of the content, impressive opening and closing, the use of suitable visual aids, the use of stories/anecdotes to illustrate a point, effective use of body language, and good handling of the question-and-answer session;
- take part in group discussions and debates successfully;
- answer questions at an elementary level in job interviews (e.g. Can you tell us something about yourself? What kinds of things do you worry about? What are your key skills? What skills do you need to improve? What do you see as your strengths? What do you like doing in your spare time? How would you describe the way you work? Tell us about a time when you showed strong leadership skills. Tell us about a time when you had to make a difficult decision. How do you see yourself in five years' time?) ;and
- use team-building skills with impact in different situations.

Course Content

UNIT–VI : Body Language
UNIT–VII : Dialogues
UNIT–VIII : Presentation Skills
UNIT–IX : Group Discussion
UNIT–X : Interviews and Telephonic Interviews
UNIT–XI : Debates

Text Books

1. Hari Prasad, et al., *Strengthen Your Communication Skills*, First Edn., Maruthi Publications, Hyderabad, 2014.
2. The following pieces of software:
   - 'Multimedia Language Lab' provided by K-Van Solution, Hyderabad
   - 'Foundation Course in Communication Skills' provided by the Andhra Pradesh State Council of Higher Education (APSCHE), Government of AP.

Testing Pattern

1. Internal **30 marks**

a. Regular performance in the Communications Lab 15 marks
b. Completing the tasks in the lab manual 05 marks
c. Making a PowerPoint presentation (Pair/Group) 10 marks
(Note: A hard copy of the presentation is to be submitted)

2. External **70 marks**

a. Test of writing
A telephone conversation 10 marks
The minimum number of exchanges to be specified
- Writing a resume 10 marks

The length (1page / 2 pages) is to be specified. The features to be included in the resume are also to be specified; the examinees will, however, have the option of including more features within the length specified.

- Answering 3 job-interview questions 15 marks

Questions at an elementary level. In other words, questions that require candidates to talk about themselves, their ambitions, , why they chose to study engineering, their strengths and weaknesses, their hobbies and interests, their personality, their perception of their leadership skills, and their key skills. Industry/job-related questions could be avoided.

Sample questions:

Can you tell us something about yourself?
What kinds of things do you worry about?
What are your key skills?
What skills do you need to improve?
What do you see as your strengths?
What do you like doing in your spare time?
How would you describe the way you work?
Tell us about a time when you showed strong leadership skills.
Tell us about a time when you had to make a difficult decision.
How do you see yourself in five years' time?

b. Test of speaking
Group discussion 20 marks
Time: 10-15 minutes (approx.) per group

c. Viva voce with an external examiner 15 marks

* * *

ELECTRONIC WORKSHOP FOR IOT

I Year – II Semester

Practical	: 4	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

- Hands-on training with identification, specification, testing of Passive and Active components
- Use of the various tools and electronic lab instruments
- Practice and develop IoT experiments.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify, test various passive and active electronic components.
- assemble, test and troubleshoot the circuits using various tools and instruments.
- simulate the circuits using software tools.
- perform the experiments using virtual laboratory.
- execute experiments based on IoT.

List of Exercises / Experiments

1. Identification, circuit symbols, test of passive components with specification and application (Resistors, Capacitors, Transformers, Relays, Switches, potentiometers, cables)
2. Identification, circuit symbol, test of active components, interpretation of data sheets, precautions to be taken (Diodes-PN junction diode, Zener, LED, Photo diode, BJT, FET, MOSFET)
3. Identification of various package types, interpretation of data sheets for ICs and SMD components.
4. Demonstrate the operation of following electronic lab instruments: Multimeter (Analog and Digital), and DC Regulated Power Supply.
5. Demonstrate the operation of following electronic lab instruments: Cathode Ray Oscilloscope (CRO), and Function Generator.
6. Inter-connection methods using Breadboard. Assembling of electronic circuits on Breadboard and measure various circuit and signal parameters using instruments.
7. Simulation of any simple electronic circuit using tools like Multisim.

8. Study virtual instruments, concept of virtual laboratory, and perform simple experiment using virtual laboratory.
9. Blynk LED application using TIVAC & CC3100 Launchpad.
10. Reading data from sensor and sending data to IoT cloud.

Reference Books

1. Robert L Boylested and Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.
2. K. A. Navas, "Electronics Lab Manual Volume I", 5th Edition, PHI Publication, 2015.

* * *

BASIC ELECTRICAL ENGINEERING LAB

I Year – II Semester

Practical	: 4	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

- To familiarize with the verification procedures of network theorems and testing methods of Electrical machines.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply Network theorems to analyze and design the electrical circuits.
- obtain performance characteristics of DC and AC machines.

List of Experiments

1. Verification of Kirchoff's Laws.
2. Verification of Superposition theorem.
3. Verification of maximum power transfer theorem.
4. Experimental verification of Thevenin's theorem.
5. Experimental verification of Norton's theorem.
6. Open & Short Circuit Tests on Single-phase transformer.
7. Brake test on D.C. Shunt Motor.
8. Speed Control of DC Shunt Motor
9. Brake test on three phase Induction Motor.
10. Identification, Specifications, Testing of R, L, C components (Colour codes).

* * *

CONSTITUTION OF INDIA
(Common to CE, ME, IoT & IT)

I Year – II Semester

Lecture	: 2	Internal Marks	: 30
Credits	: -	External Marks	: 70

Course Objectives

- To impart knowledge on basic engineering applications.
- To enable the student to understand the importance of constitution.
- To understand the structure of Executive, Legislature and Judiciary.
- To understand Philosophy of fundamental rights and duties.
- To understand the autonomous nature of constitution bodies like Supreme Court and High Court Controller and Auditor General of India and Election Commission of India.
- To understand the Central and State relation, financial and administrative.

Course Outcomes

Upon successful completion of the course, the students will be able to

- understand history and philosophy of constitution with reference to Preamble, Fundamental Rights and Duties
- understand the concept of Unitary and Federal Government along with the role of President, Prime Minister and Judicial System.
- structure of the state government, Secretariat, Governor and Chief Minister and their functions.
- learn local administration viz. Panchayat, Block, Municipality and Corporation.
- learn about Election Commission and the process and about SC, ST, OBC and women.

Course Content

UNIT – I:

Introduction to Indian Constitution: 'Constitution' meaning of the term, Indian Constitution – Sources and Constitutional History, Features – Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT – II:

Union Government and its Administration Structure of the Indian Union: Federalism Centre – State relationship, President: Role, Power and Position. Prime Minister (PM) and Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. The Supreme Court and High Court: Powers and Functions.

UNIT – III:

State Government and its Administration Governor – Role and Position – Chief Minister (CM) and Council of Ministers. State Secretariat: Organisation, Structure and Functions.

UNIT – IV:

A Local Administration – District's Administration Head – Role and Importance, Municipalities – Mayor and Role of Elected Representative – Chief Executive Officer (CEO) of Municipal Corporation Panchayati Raj : Functions Panchayati Raj Institution (PRI), Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: Block level orgnisational Hierarchy – (Different Departments), Village level – Role of Elected and Appointed officials – Importance of grass root democracy.

UNIT – V:

Election Commission: Election Commission – Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions and Commissions for the welfare of SC/ST/OBC and Women.

Reference Books

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd., New Delhi.
2. Subash Kashyap, Indian Constitution, National Book Trust.
3. J.A. Siwach, Dynamics of Indian Government and Politics.
4. D.C. Gupta, Indian Government and Politics.
5. H.M.Sreevai. Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication).
6. J.C. Johari, Indian Government and Politics Hans.
7. J.Raj, Indian Government and Politics.
8. M.V. Pylee, Indian Constitution, Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd., New Delhi.
9. Noorani, A.G. (South Asia Human Rights Documentation Centre), Challenges to Civil Right). Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

E-Resources:

1. nptel.ac.in/courses/109104074/8.
2. nptel.ac.in/courses/109104045.
3. nptel.ac.in/courses/101104065.
4. www.hss.iitb.ac.in/en/lecture-details.
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution.

* * *

ANALOG DEVICES AND CIRCUITS

II Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with the operation and characteristics of electronic devices.
- To know about the physical structure and operation of MOSFETs and BJTs
- To acquaint with the concept of feedback, types and its application in different amplifier and oscillator circuits.
- To inculcate the operation and applications of OP-Amps and timer ICs.

Course Outcomes

Upon successful completion of the course, the students will be able to

- study the characteristics and models for diodes and use them for various applications.
- characterize the current flow in BJTs and MOSFETs and study their applications as switch and as an amplifier.
- identify different configurations of op-amp and demonstrate different applications using op-amps.
- describe different feedback configuration in amplifiers and deduce the expressions for frequency of oscillations of RC and LC oscillators.
- differentiate various types of multivabrators, A/D and D/A converters.

Course Content

UNIT – I: PN-Junction Diode

Drift and Diffusion currents, PN-junction with open-circuit terminals, PN-junction with an applied voltage, Capacitive effects in PN-Junctions, Terminal characteristics of junction diodes, Modelling the diode forward characteristics- ideal diode model, piece wise linear model and constant-voltage-drop.

Special Diodes(only characteristics and applications) **:** LED, Photo Diode, Tunnel Diode, Varactor Diode.

UNIT – II: MOS FETs and BJTs

MOS FET: Device structure and physical operation, current-voltage characteristics,MOSFET operation as a switch and as a linear amplifier. BJT: Device structure and physical operation, current-voltage characteristics, BJT operation as a switch and as an amplifier

UNIT – III: Operational Amplifier and Applications

Ideal Operational amplifier, Inverting amplifiers, Non-inverting amplifiers, Voltage follower, Differential Amplifier, Summing amplifier, Instrumentation Amplifier, Voltage to current and current to voltage converters, Precision diode, Peak detector, Comparator.

UNIT – IV: Feedback Amplifiers & Oscillators

Feedback concept, negative & positive feedback, voltage/current, series/shunt feedback, Barkhausen criterion, Phase shift and Wein bridge oscillators, Colpitts, Hartley's, and crystal oscillators.

UNIT – V: Multivibrators and Data Converters

The 555 circuit, Monostable and Astable multi vibrators using 555 timer, Data converters: D/A converter circuits, A/D converter circuits.

Text Books

1. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press Inc., International 5th Edition, 2004.
2. D. Roy Choudhury and Shail B.Jain, "Linear Integrated Circuits", New Age International (p) Ltd, 4th Edition, 2010.

Reference Books

1. Ben G. Streetman and Sanjay Kumar Banerjee, "Solid State Electronic Devices", PHI Learning Private Limited, 6th Edition, 2009.
2. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press Inc., International 6th Edition, 2010.
3. Robert L.Boylestad and Louis Nashelsky, " Electronics Devices and Circuit Theory", 11th Edition, Pearson Education.

* * *

PRINCIPLES OF COMMUNICATION SYSTEMS

II Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the fundamentals of analog communication systems and various techniques for analog modulation and demodulation schemes.
- To acquaint with different pulse digital modulation and digital modulation techniques.

Course Outcomes

Upon successful completion of the course, the students will be able to

- disseminate the fundamentals of analog modulation schemes and different multiplexing techniques.
- understand the functioning of AM and FM transmitters and receivers.
- distinguish different pulse digital modulation systems.
- elucidate different digital modulation techniques.

Course Content

UNIT – I: Linear Modulation

Introduction, Need for modulation, Amplitude Modulation- Definition, Time domain and frequency domain description, power relations in AM waves, Generation and detection of AM Waves; DSBSC MODULATION- Time domain and frequency domain description, Generation of DSBSC Waves, Coherent detection of DSBSC Modulated waves, Costas loop.

UNIT – II: SSB Modulation& AM Transmitters and Receivers

SSBSC MODULATION-Time domain description, Frequency domain description.Classification of Transmitters, AM Transmitters: high level and low level AM transmitters; Receiver Types- Tuned radio frequency receiver, Super heterodyne receiver; FDM.

UNIT – III: Angle Modulation

Introduction to Angle Modulation, Relation between Frequency Modulation and Phase Modulation, Single tone Frequency Modulation, Narrow band FM, Wide band FM; Generation of FM Waves: Detection of FM Waves, FM Transmitter, FM Receiver.

UNIT – IV: Pulse Digital Modulation

Elements of digital communication systems, TDM, elements of PCM, multiplexing, synchronization, companding in PCM systems, differential PCM systems (DPCM), Delta modulation, noise in PCM & DM systems, comparison of PCM & DM systems.

UNIT – V: Digital Modulation

Phase Shift Keying, Differential Phase Shift Keying, Quadrature Phase Shift Keying, Amplitude Shift Keying, Frequency Shift Keying, similarity of BFSK and BPSK.

Text Books

1. Simon Haykin, John Wiley, "Communication Systems", 2nd Edition, John Wiley.
2. George Kennedy and Bernard Davis, "Electronics & Communication Systems", TMH Publishers, 2004.
3. Simon Haykin, "Digital Communications", John Wiley Publishers, 2005.

Reference Books

1. H.Taub & D. Schilling, Gautam Sahe, "Principles of Communication Systems", 3rd Edition, TMH Publishers, 2007.
2. B.P.Lathi, Zhi Ding, "Modern Analog and Digital Communications", 4th Edition, Oxford University Press.
3. John G. Proakis, Masond Salehi, "Fundamentals of Communication Systems", 2nd Edition, Pearson Education, 2006.
4. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley Publishers, 2005.

* * *

PROBABILITY AND STATISTICS
(Common to CSE, IT and IoT)
II Year – I Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To introduce the concepts of probability and statistics.
- To impart knowledge on sampling theory,correlation - regression and curve fitting.

Course Outcomes

Upon successful completion of the course, the students will be able to

- find the mean, variance and different probabilities.
- construct sampling distributions, confidence intervals and to find maximum error of estimates for population parameters.
- validate given hypothesis in case of large sample problems.
- examine the given hypothesis in case of exact samples.
- measure the association between the variables and to fit different curves to the given data.

Course Content

UNIT – I: Probability Distributions

Probability – Conditional probability and Baye's theorem [Review] – Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation and Variance – Binomial and Poisson distributions. Continuous distributions - Exponential and Normal distributions.

UNIT – II: Sampling

Introduction to Population and Sample – Sampling distribution of Means and Variances– Applications of Central limit theorem (without proof) – Point and Interval estimations – Construction of Confidence intervals for means and proportions. Maximum error of estimate.

UNIT – III: Statistical Inference – I(Large Samples)

Null hypothesis - Alternative hypothesis- level of significance. Type-I and Type-II errors- One tailed and two tailed tests- Testing of hypothesis concerning means and proportions (applications).

UNIT – IV: Statistical Inference - II (Exact Samples)

Concept of degrees of freedom t- test, F-test, χ^2 -test (independence of attributes) and their applications.

UNIT – V: Correlation – Regression and Curve fitting

Simple Correlation – correlation coefficient and its properties –, Spearman's rank correlation – regression coefficients and its properties – regression lines. Method of least squares – Straight line, Second Degree, Exponential and Power curves.

Text Books

1. Dr. T. K. V. Iyengar, Dr. B. Krishna Gandhi, S. Ranganatham and Dr. M.V. S. S. N. Prasad, "Probability and Statistics", S. Chand & Company Ltd., New Delhi.
2. Miller, John E. Freund, "Probability and Statistics for Engineers", PHI, Delhi.

Reference Books

1. S.C. Gupta & V.K. Kapoor, "Fundamentals of Mathematical Statistics", S.Chand& Company Ltd., New Delhi.
2. B.V. Ramana, "Engineering Mathematics", 4th Edition, Maitrey Printers Pvt. Ltd., 2009, India.

* * *

ELECTRONIC INSTRUMENTATION AND MEASUREMENT PRINCIPLES
(Common to ECE and IoT)

II Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the measuring systems, analog instruments principles, and gain knowledge on the application of instruments
- To introduce the construction and application of the signal generators and oscilloscopes.

Course Outcomes

Upon successful completion of the course, the students will be able to

- recognize the evolution and history of units and standards in Measurements.
- identify the various parameters that are measurable in electronic instrumentation
- understand operation of bridges and application
- demonstrate understanding of various signal generators and anlyzers
- understand different cathode ray oscilloscopes

Course Content

UNIT – I: Characteristics of Instruments and Measurement Systems

Measurement system performance-static characteristics, errors in measurement, true value, statics correction, debugging and testing; Static Characterstics-repeatability, accuracy and precession, linearity, hysteresis, resolution of instrument.

UNIT – II: Analog Instruments

Classification of analog instruments-principles of operation, control systems, damping systems; D'Arsonval movement-galvanometer, response of galvanometer, overshoot, sensitivity; meters-ammeter, voltmeter.

UNIT – III: Electromechanical Indicating Instruments& Bridges

Ohm meters-series type ohmmeter, shunt type ohmmeter, calibrating of DC instruments; Bridges-wheatstone bridge, maxwell bridge, hay bridge, schering bridge, wein bridge.

UNIT – IV: Signal generators

Signal generators-sine wave generators, sweep-frequency generators, pulse and

square wave generators, function generators, audio frequency signal generation, Wave analyzers-wave analyzers, harmonic distortion analyzers, spectrum analyzers.

UNIT – V: Oscilloscopes

Deflection system-oscilloscope block diagram, cathode ray tube, vertical deflection system, horizontal system, delay line; Special oscilloscope-dual trace oscilloscopes, dual beam oscilloscopes, measurement of frequency .

Text Books

1. Albert D.Helfrick, William D.Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 5th Edition, PHI, 2002.
2. A.K. Sawhney, "Electrical& Electronic measurements and instrumentation", 19th edition, Dhanpat Rai & Co., 2014.

Reference Books

1. S. Salivahnan, R Rengaraj, G R Venkatakrishnan, "Basic Electrical, Electronics and Measurement Engineering", TMH, 2018.
2. R.K.Rajput, "Electrical and Electronic Measurement and Instrument", S.Chand & Company Ltd., New Delhi, 2008.

* * *

TRANSDUCERS AND SIGNAL CONDITIONING

II Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with the characteristics and operation of measuring instruments.
- To introduce the concepts of passive and active Transducers.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify the instruments based on static and dynamic characteristics.
- understand the principle of electronic measuring instruments operation.
- applying the concepts of passive and active transducers to design new measuring equipment.
- design electronic measuring equipment suitable for required applications.

Course Content

UNIT – I: Measurement Systems

Basic electronic measuring system-Transduction principles, Classification of transducers, characteristics, Criteria for transducer selection; Resistive Transducers-Principles of operation, construction, Potentiometers, strain gauges, metallic and semi-conductor type, Resistance Thermometer, Thermistors.

UNIT – II: Inductive and Capacitive Transducers

Inductive Transducers**-**Principles of operation, construction, variable Inductive Transducers, LVDT (Linear variable differential transformer); Capacitive Transducers-Types, Principles of operation, construction, capacitive transducers based upon familiar equation of capacitance.

UNIT – III: Active Transducers

Principle of operation, construction, theory, Thermocouple, Piezo-electric transducer, Magneto-strictive transducer, Hall effect transducer, Electrochemical transducer.

UNIT – IV: Optical Transducers

Photo-emissive, photo-conductive and Photo-voltaic cells, Digital, Optical encoder, Shaft encoder, introduction to inverse transducer.

UNIT – V: Signal Conditioning

Concept of signal conditioning, Instrumentation amplifiers, analog-digital sampling, introduction to A/D and D/A conversion.

Text Books

1. Kalsi H S, “Electronic Instrumentation”, 4th Edition, Tata McGraw Hill, New Delhi, 2001.
2. Sawhney A K, “Electrical and Electronics Measurements and Instrumentation”, Dhanpat Rai and Sons, New Delhi, 2000.
3. Murty D.V.S, “Transducers & Instrumentation”, PHI, New Delhi, 2000.

Reference Books

1. Patranabis D, “Sensors and Transducers”, PHI, New Delhi, 2003.
2. Doebelin Ernest O, “Measurement Systems: Application and Design”, Tata McGraw Hill, New Delhi, 2004.

* * *

DATA STRUCTURES
(Common to ECE and IoT)
II Year – I Semester

Lecture : 2	Practical : 2	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To impart knowledge of linear and non-linear data structures.
- To familiarize with different sorting and searching techniques.

Course Outcomes

Upon successful completion of the course, the students will be able to

- design algorithms to create, search, insert, delete and traversal operations on linear and non-linear data structures.
- implement stacks, queues and linked list.
- perform the operations on binary search trees
- write algorithms for searching and sorting techniques.
- develop algorithms for systematic traversal of a graph.

Course Content

UNIT – I: Linked Lists

Introduction - Concept of data structures, overview of data structures, implementation of data structures.

Linked Lists – Single linked list, circular linked list, double linked list, circular double linked list.

Programs:

1. Use functions to
   i. Create a singly linked list. ii. Insert an element into a singly linked list.
   iii. Delete an element from a singly linked list.
2. Use functions to
   i. Create a circular linked list. ii. Insert an element into a circular linked list.
   iii. Delete an element from a circular linked list.

UNIT – II: Stacks and Queues

Stack: Representation using arrays and linked list, operations on stack, factorial calculation, evaluation of arithmetic expression.

Queue: Representation using arrays and linked list, operations on queue, circular queue, queue using stack.

Programs:

3. Implement stack (its operations) using arrays.
4. To convert infix expression into postfix expression.
5. Implement queue (its operations) using linked lists.

UNIT – III: Trees

Binary Trees: Basic tree concepts, properties, representation of binary trees using arrays and linked list, binary tree traversals, threaded binary tree.

Binary search trees: Basic concepts, BST operations: search, insertion, deletion and traversals, creation of binary search tree from in-order and pre (post) order traversals.

Programs:

6. Create a binary search tree of integers and perform the following operations
   i. Insert ii. Traversals (pre-order, in-order, post-order)

UNIT – IV: Sorting and Searching

Searching: Linear search, Binary search, Fibonacci search.

Sorting (Internal): Basic concepts, sorting by: insertion (Insertion sort), selection (selection sort), exchange (Bubble sort, quick sort), distribution (radix sort) and merging (merge sort).

Programs:

7. Develop recursive and non-recursive functions to perform search for a key value in a given list using
   i. Linear Search ii. Binary Search
8. Implement the following sorting techniques to sort a given list of integers in ascending order
   i. Bubble sort ii. Insertion sort iii. Selection sort

UNIT – V: Graphs

Basic concepts, representations of graphs, operations on graphs-vertex insertion, vertex deletion, find vertex, edge addition, edge deletion, graph traversals-DFS and BFS.

Text Books

1. Debasis Samanta, "Classic Data Structures", 2nd Edition, PHI Publisers, 2011.
2. Richard F. Gilberg, Forouzan, "DataStructures", 2nd Edition, Cengage Learning.

Reference Books

1. Seymour Lipschutz, "Data Structure with C", TMH Publishers, 2017.
2. G.A.V.Pai, "Data Structures and Algorithms", TMH Publishers, 2008.
3. Horowitz, Sahni, Anderson Freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press.

* * *

ANALOG DEVICES AND CIRCUITS LAB

II Year – I Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To familiarize with the development of applications using PN junction and special diodes.
- To conduct experiments for obtaining the characteristics of diodes, BJTs, circuits using 741 and 555 timer ICs etc.

Course Outcomes

Upon successful completion of the course, the students will be able to

- verify the I-V characteristics of junction diode, Zener diode, BJT, and obtain their parameters.
- use modern tools for simulation.
- develop applications of diode such as DC power supply, Zener voltage regulator,
- develop various applications like summer, comparator, integrator and differentiators, DAC, oscillators using 741 op-amp and multivibrator using 555 timer.

List of Experiments

1. I-V characteristics of Junction diode and breakdown characteristics of Zener diode.
2. Full Wave Rectifier with and without Capacitor Filter.
3. Zener Voltage regulator.
4. BJT Common Emitter Characteristics.
5. Summing Amplifier and Comparator using IC 741 op-amp.
6. Astable Multivibrator using IC 555 timer.
7. R-2R Ladder type DAC.
8. Shunt-shunt feedback amplifier.
9. RC Oscillators (Simulation).
10. LC Oscillators (Simulation).
11. Open-ended experiment.

Additional Experiments:

1. Transistor as a switch (BJT, MOSFET).
2. Diode logic gates.
3. Peak rectifier.
4. Varactor diode characteristics.
5. Slicer.

6. BJT and MOSFET Fixed bias circuit.
7. BJT collector to base bias.
8. CB and CC characteristics.
9. Integrator/Differentiator

Reference Books

1. Adel S. Sedra and Kenneth C. Smith, “Microelectronic Circuits”, Oxford University Press Inc., 2004.
2. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 11th Edition, Pearson Education Inc., 2013.
3. K. Radha Krishna Rao, “Electronics for Analog Signal Processing - I”, NPTEL Video Course.
4. User manuals for basic electronic lab equipment.
5. Data sheets for electronic components.

* * *

ANALOG AND DIGITAL COMMUNICATIONS LAB
(Common to ECE and IoT)
II Year – I Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To familiarize with various analog and digital modulation schemes.
- To introduce the error detection and correction capabilities of linear block codes.

Course Outcomes

Upon successful completion of the course, the students will be able to

- verify the sampling process with different sampling rates.
- compare the operation of various analog and digital modulation schemes.
- distinguish Frequency Shift Keying and Differential Phase Shift Keying techniques.
- test linear block encoders and decoders.

List of Experiments

Perform any ten out of the following experiments

1. Analyze and test AM- Modulation and Demodulation.
2. Power Analysis of AM and FM signals using Spectrum Analyzer.
3. Sampling Theorem verification.
4. Analyze and test DSB-SC Modulation and Demodulation.
5. Analyze and test Frequency Modulation and Demodulation.
6. Pulse Code Modulation and Demodulation.
7. Delta Modulation and Demodulation.
8. Frequency Shift Keying.
9. Differential Phase Shift Keying.
10. Amplitude Shift Keying.
11. Linear block encoder and decoder.
12. Pre-emphasis and De-emphasis.
13. Time Division Multiplexing.
14. Open ended experiment (Mandatory).

References

1. Simon Haykin, “Digital Communications” John Wiley, 2005.
2. H. Taub and D. Schilling, “Principles of Communication Systems”, TMH, 2003.
3. Sam Shanmugam, “Digital and Analog Communication Systems”, John Wiley, 2005.
4. John Proakis, “Digital Communications”, TMH, 1983.
5. B.P.Lathi, “Modern Analog and Digital Communication”, 3rd Edition, Oxford reprint, 2004.

* * *

LOGIC BUILDING AND ALGORITHMIC PROGRAMMING
(Common to ECE, CSE, IT, AI&DS, IoT, CSE (AI&ML))

II Year – I Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

- Analysis of Algorithms
- Searching and Sorting
- Greedy Algorithms
- Dynamic Programming
- Pattern Searching
- Other String Algorithms
- Backtracking
- Divide and Conquer
- Geometric Algorithms
- Mathematical Algorithms
- Bit Algorithms
- Graph Algorithms
- Randomized Algorithms
- Branch and Bound
- Quizzes on Algorithms

SIGNAL ANALYSIS AND PROCESSING

II Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To familiarize with the basic concepts of signals and systems.
- To introduce various transform techniques on signals.
- To develop an understanding of sampling and correlation techniques on signals.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify the signals and perform various operations on signals.
- perform Fourier analysis on the signals.
- analyze the various systems.
- perform correlation operations on signals.
- apply various sampling techniques on continuous time signals.
- analyze various continuous time signals through transformation (Fourier and Laplace) techniques.

Course Content

UNIT – I: Signal Analysis

Introduction to elementary signals - unit step, impulse, ramp, parabolic, rectangular, triangular, sinusoidal, exponential, signum, sinc and gaussian functions, basic operations on signals - amplitude and time scaling, time shifting, addition and multiplication, Classification of signals.

UNIT – II: Fourier Series Representation of Continuous Time Signals

Trigonometric and exponential Fourier series for periodic functions, relationship between trigonometric and exponential Fourier series, convergence of Fourier series (Dirichlet conditions), alternate form of trigonometric series (Cosine form), symmetry conditions-even and odd, complex Fourier spectrum.

UNIT – III: Fourier Transform

Representation of an arbitrary function over the entire interval: Fourier transform, Fourier transform of some useful functions and periodic function, properties of Fourier transform, energy density spectrum, Parseval's theorem.

Sampling: Sampling theorem for band limited signals- explanation, reconstruction of signal from samples, aliasing, sampling techniques- impulse, natural and flat top sampling.

UNIT – IV: LTI Systems

Properties of systems, Linear Time Invariant (LTI) system, response of LTI system -convolution integral, properties of LTI system, transfer function and frequency response of LTI system.

Signal Transmission Through LTI Systems: Filter characteristics of LTI systems, distortion less transmission through LTI system, signal bandwidth, System bandwidth, ideal LPF, HPF and BPF characteristics, causality and physical realizability- Paley-Wiener criterion, relationship between bandwidth and rise-time.

UNIT – V: Correlation of Continuous Time Signals

Cross correlation and auto correlation of continuous time signals (finite and nonfinite energy signals), relation between convolution and correlation, properties of cross correlation and autocorrelation.

Laplace Transform: Laplace transform of signals, properties of Region of Convergence (ROC), unilateral Laplace transform, properties of unilateral Laplace transform, inversion of unilateral Laplace transform – Partial Fraction Method.

Text Books

1. B.P.Lathi, “Signals, Systems & Communications”, BS Publications, 2003.
2. A.V.Oppenheim, A.S.Willsky, S.H.Nawab, “Signals and Systems”, 2nd Edition, PHI Publishers.

Reference Books

1. Simon Haykin, Van Veen, “Signals & Systems”, 2nd Edition, Wiley Publishers.
2. Michel J. Robert , “Fundamentals of Signals and Systems”, Tata McGraw Hill International Edition, 2008
3. C.L.Philips, J.M. Parr, Eve A. Riskin, “Signals, Systems and Transforms”, 3rd Edition, Pearson Education, 2004.

* * *

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

II Year – II Semester

Lecture : 2	Practical : 2	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To familiarize with the concepts of object oriented programming.
- To impart the knowledge of applet creation.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply Object Oriented approach to design software.
- create user defined interfaces and packages for a given problem.
- develop code to handle exceptions.
- implement multi tasking with multi threading.
- develop Applets for web applications and able to do event handling.

Course Content

UNIT – I: Fundamentals of OOP and Java

Need of OOP, principles of OOP languages, procedural languages vs. OOP, Java virtual machine, Java features.

Java Programming constructs: variables, identifiers, primitive data types, keywords, literals, operators, arrays, type conversion and casting.

Problem Solving: Write a Java Program

1. to calculate the remainder of division without using remainder operator.
2. to calculate the product of two numbers without using multiplication operator.
3. to check whether two integers are equal or not without using equality operator.
4. to find sum of the elements of an array.
5. to display default initial values of all primitive data types in java.

UNIT – II: Class Fundamentals and Inheritance

Class fundamentals-declaring objects and methods, recursive methods, nested method calling,returning of objects, Parameter passing techniques, Instance initializer blocks, constructors, overloading-methods and constructors,this and static keywords,nested classes.

Inheritance**-** Basics, types, using method overriding, dynamic method dispatch, abstract classes, super and final keywords, access control with inheritance, Object class.

Problem Solving: Write a Java Program

1. to calculate the factorial of a given number using recursive method.

2. to overload a method called area(), where the method computes the area of a square if the number of parameters are 1 otherwise if the numbers of parameters are 2 it needs to compute the area of a rectangle.
3. to Create an abstract class named shape, that contains an empty method named numberofsides(). Define three classes named Trapezoid, Triangle and Hexagon, such that each one of the classes contains only the method numberofsides(), that contains the number of sides in the given geometrical

UNIT – III: Interfaces and Packages

Interfaces: Defining an interface, implementing interfaces, variables in interfaces and extending interfaces, How to achieve multiple inheritance, nested interfaces, class within interface and interface within class, interfaces with default and static methods, up-casting and down-casting, List of marker interfaces and its Usage: Cloneable interface, Introduction to Collection framework, lambda expressions in Java.

Packages: Predefined packages, creating and accessing user defined packages, package hierarchy, multiple classes in single package and access controls with packages.

Problem Solving: Write a Java program

1. to create and access a user defined package where the package contains a class named CircleDemo, which contains a method called circleArea() which takes radius of the circle as the parameter and returns the area of the circle.
2. to design an interface with a method reversal. This method takes a string as its input and implement the method [do not use predefined methods].
3. to count the number of words and characters in a string.

UNIT – IV: Exception Handling and Multithreading

Exception Handling- Fundamentals, Types of exceptions, using try and catch, multiple catch clauses, nested try statements, try with resources, throw, throws, finally, re-throwing an exception, user-defined exceptions, Throwable class.

Multithreading-Introduction to multitasking, multi-threading vs multi-tasking, thread life cycle, Thread Creation,Thread class constructors, Thread priorities and its methods, synchronizing threads, daemon threads, Garbage Collection, thread groups and its methods.

Problem Solving: Write a java program

1. to handle division by zero exception.
2. to handle array index out of bounds exception.
3. to create a user defined exception, that raises an exception such that if the number of marks obtained by a student is < 0 or > 10, and print the exception description as “marks out of range”.

4. to create three threads by using Thread class where the first thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.

UNIT – V: Applets and Event Handling

Applets- Concepts of applets, differences between applets and applications, life cycle of an applet, creating applets, applet parameters.

Event Handling**-** delegation event model, Events, event sources, event classes, event listeners, handling mouse and keyboard events, adapter classes, AWT hierarchy, Basic user Interface components, Layout managers, Introduction to swings.

Problem Solving: Write a java program

1. to create an applet which displays "hi" at the top center of the applet and "bye" at the bottom right of the applet.
2. to handle the keyboard events such that only the currently typed character should be displayed in the applet.
3. to handle the keyboard events such that all the typed text should be displayed in the applet.

Text Books

1. Herbert Schildt, "Java - The Complete Reference", 11th Edition, TMH Publishers.
2. Sachin Malhotra, Saurabh choudhary, "Programming in Java", 2nd Edition, Oxford.

Reference Books

1. Joyce Farrel, Ankit R.Bhavsar, "Java for Beginners", 4th edition, Cengage Learning.
2. Y.Daniel Liang, "Introduction to Java Programming", 7th edition, Pearson Education.

* * *

DIGITAL CIRCUITS DESIGN
(Common to ECE and IoT)
II Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To familiarize with the concepts of different number systems and Boolean algebra.
- To introduce the design techniques of combinational, sequential logic circuits.

Course Outcomes

Upon successful completion of the course, the students will be able to

- perform various number system conversions.
- design various logic circuits using Boolean laws.
- design combinational and sequential logic circuits.
- implement logic expressions using PLDs.

Course Content

UNIT – I: Boolean Algebra and Logic Gates

Number Systems - Binary numbers, Octal, Hexadecimal, Other Binary Codes; Complements, Signed binary numbers, Digital logic operations and gates, Basic theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard Forms, Complements of Boolean functions, Two-level NAND and NOR Implementation of Boolean functions.

UNIT – II: Combinational Logic Circuits

The Map Method (upto Four Variables), Don't care conditions, Design Procedure, Adders, Subtractors, 4-bit Binary Adder/ Subtractor circuit, BCD adder, carry look-a-head adder, Decoders and Encoders, Multiplexers, Demultiplexers.

UNIT – III: Sequential Logic Circuits

Design Procedure, Latches, Flip-Flops, truth tables and excitation tables, Conversion of flip-flops, Design of Counters, Ripple Counters, Synchronous Counters, Ring Counter, Johnson Counter, Registers, shift registers, universal shift register.

UNIT – IV: Finite State Machines

Types of FSM, Capabilities and limitations of FSM, Finite state machine definitions, Synchronous Sequential machine models, Minimization of completely specified sequential machines using partition technique.

UNIT – V: Programmable Logic Devices

Types of PLD's: PROM, PAL, PLA, Logic expression implementation using PROM, PAL, PLA, Basic structure of CPLD and FPGA, Advantages and Disadvantages of FPGA's.

Text Books

1. M. Morris Mano, “Digital Design”, 3rd Edition, PHI Learning Pvt. Ltd.
2. A. Anand Kumar, “Switching Theory and Logic Design”, PHI Learning Pvt. Ltd., 2016.

Reference Books

1. Stephen M. Trimberger , “ Field – Programmable Gate Array Technology” Springer Special Edition.
2. Hill and Peterson, “Switching theory and Logic Design”, Mc-Graw Hill Publishers, 2012.
3. Charles H. Roth, Jr, “Fundamentals of Logic Design”, 4th Edition, Jaico Publishers.
4. A. P. Malvino, D. P. Leach, “Digital Principles and Applications”, 4th Edition, TMH Publishers.
5. Zvi Kohavi and Niraj K.Jha, “Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.

* * *

COMPUTER ORGANIZATION AND ARCHITECTURE

II Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce how computers are constructed out of a set of functional units and how the functional units operate, interact, and communicate.
- To familarize with the concept of interfacing memory and various I/O devices to a computer system

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply the knowledge of computer system in designing the architecture of the system and its peripherals.
- demonstrate the fundamentals of central processing unit and describe the operational characteristics of the control unit.
- determine the algorithms related to computer arithmetic.
- analyze the function of the memory management unit and create suitable memory interface to the CPU.
- select an appropriate I/O data transfer to meet specified performance requirements.

Course Content

UNIT – I: Basic Computer System

Function and structure of a computer, Functional components of a Computer, Interconnection of components, Bus interconnections, Performance of a computer. **Representation of Instructions**: Machine instructions, Memory locations & Addresses, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

UNIT – II: Basic Central Processing Unit

Processor organization, register organization, Instruction cycle, Instruction pipelining, Control unit, Micro-operations, control of the processor, Hardwired control, Micro programmed control, micro instruction sequencing, micro instruction execution.

UNIT – III: Computer Arithmetic

Addition and subtraction, multiplication algorithms, division algorithms, floating point arithmetic operations, decimal arithmetic unit, decimal arithmetic operations.

UNIT – IV: The Memory System

Memory Hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory.

UNIT – V: Input Output Organization

Peripheral devices, input-output interface, asynchronous data transfer modes of transfer, priority interrupt, direct memory access, serial communication.

Text Books

1. William Stallings, "Computer Organization and Architecture, 8/e, Pearson Education.
2. M.Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education.

Reference Books

1. J .P. Hayes, "Computer Architecture and Organization", McGraw-Hill Publishers, 1998.
2. Hamachar, Vranesic, "Computer Organization, 5th Edition, Tata McGraw Hill Publishers.
3. V. Rajaraman, T. Radhakrishnan, "Computer Organization and Architecture", PHI Learning, 2007.
4. Pal Choudary, "Computer Organization and Design", PHI Learning, 2007.

* * *

NUMERICAL METHODS AND COMPLEX ANALYSIS
(Common to ECE and IoT)
II Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To learn various numerical techniques to solve engineering problems.
- To understand the procedures to evaluate differentiation and various types of integrations over complex field.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply numerical techniques for solutions of algebraic and transcendental equations.
- evaluatedefinite integrals by using different numerical techniques and solve ordinary differential equations numerically.
- test the analyticity of a complex function.
- determination of the complex integration with the use of Cauchy's integral formulae.
- evaluation of real definite integral by using Residue theorem.

Course Content

UNIT – I: Algebraic and Transcendental Equations, Interpolation

Solution of Algebraic and Transcendental Equations : Introduction –Newton-Raphson Method.**Interpolation:** Introduction – Finite differences – Forward differences – Backward differences – Newton's interpolation for equally spaced points – Lagrange's interpolation for unequally spaced points.

UNIT – II: Numerical Integration and Solutions of Ordinary Differential Equations

Numerical Integration: Review of Trapezoidal and Simpon's rules. 2 and 3 point Gaussian quadrature formulae- Romberg integration.

Numerical solutions of Ordinary Differential Equations: Euler Method - Modified Euler Method - Runge–Kutta Fourth order Method.

UNIT – III: Functions of a Complex Variable

Introduction – Continuity – Differentiability –Analytic functions - C-R equations in Cartesian and Polar coordinates - Harmonic functions - Milne – Thompson method.

UNIT – IV: Complex Integration and Series Expansions

Complex integration: Evaluation of complex integral along the path - Cauchy's integral theorem (statement) - Cauchy's integral formula - problems.

Series expansions: Taylor's series -Maclaurin's series - Laurent series.

UNIT – V: Singularities and Residue Theorem

Singularity - types of singularities -Isolated - Removable - Essential - Simple pole - Pole of order m -Calculation of residues - Residue at a pole of order m - Residue theorem (without proof) -Evaluation of real integral of the type $\int_{-\infty}^{\infty} f(x)dx$.

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley &Sons,INC., 2011.
2. B.S.Grewal, Higher Engineering Mathematics, 45th edition, Khanna Publishers, New Delhi, 2015.

Reference Books

1. R. K. Jain &S.R.K. Iyengar, Numerical Methods, New age International Publication (P) Ltd.
2. Shanti Narayan & P.K. Mittal, Theory of Functions of Complex Variable, S.Chand& Co.

* * *

DIGITAL CIRCUITS DESIGN LAB
(Common to ECE and IoT)
II Year – II Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To acquaint with the design of various digital circuits.
- To familiarize with the simulation process of CAD tools.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply Boolean laws and K-map to simplify the digital circuits.
- draw the digital circuits using gate level implementation.
- demonstrate the flow of Electronic Workbench.
- develop digital circuits using Electronic Workbench.

List of Experiments

To design and perform simulation for the following digital circuits using Electronic Workbench

1. Basic Logic Gates using Universal Gates
2. Full adder using Half adder and Logic gates.
3. 4-bit Carry Look Ahead Adder
4. Realization of Boolean Expression using 8:1 multiplexer.
5. Seven Segment Display using Decoder
6. 8:3 Priority Encoder
7. JK and D flip-flops.
8. Shift register
9. Asynchronous Decade Counter
10. Johnson's Counter
11. Open Ended Experiment

Reference Books

1. Thomas L. Floyd, "Digital Fundamentals", 3rd edition, Universal Book Stall.

2. Ala B. Marcovitz, “Introduction to Logic Design”, 3rd Edition, McGraw-Hill Publishing.
3. Hill and Peterson, “Switching theory and Logic Design”, Mc-Graw Hill Publishers, 2012.
4. Charles H. Roth, Jr, “Fundamentals of Logic Design”, 4th Edition, Jaico Publishers.

* * *

SIGNAL ANALYSIS AND PROCESSING LAB

II Year – II Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To familiarize with the simulation of signals and perform mathematical operations on signals.
- To introduce the system properties and model it mathematically.

Course Outcomes

Upon successful completion of the course, the students will be able to

- perform basic mathematical operations on signals and classifying the systems.
- perform Fourier analysis on the signals.
- analyze the LTI system.
- perform convolution and correlation operational on signals.
- analyze the various continuous time signals through transformation (Fourier and Laplace) techniques.

List of Experiments

1. Basic Operations on Matrices.
2. Generation of basic continuous time signals namely unit impulse, step, ramp, exponential and Sinusoidal signals.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4. Finding the Even and Odd Parts of Signal or Sequence and Real and Imaginary Parts of Signal.
5. Finding the Trigonometric Fourier Series of a given Signal.
6. Finding the Fourier Transform of a given Signal and plotting its Magnitude and Phase spectrum.
7. Verification of linearity and time invariance properties of a given continuous system.
8. Computation of Unit Sample, Unit Step and Sinusoidal Responses of the Given LTI System and Verifying its Physical Realizability and Stability Properties.
9. Convolution between Signals and Sequences.
10. Autocorrelation and Cross correlation between Signals and Sequences.
11. Open-ended experiment – Properties of Laplace Transform.

Reference Books

1. B.P.Lathi, “Signals, Systems &Communications”, BS Publications, 2003.
2. A.V. Oppenheim, A.S. Willsky and S.H.Nawab, “Signals and Systems”, 2nd Edition, PHI.

* * *

PYTHON PROGRAMMIANG
(Common to ECE and IoT)
II Year – II Semester

Practical: 4	Internal Marks : 15
Credits : 2	External Marks : 35

Course Objectives

- To familiarize with the basic commands of the python.
- To introduce object-oriented programming concepts in problem solving.

Course Outcomes

Upon successful completion of the course, the students will be able to

- explore various modern tools used for python.
- apply the basic built-in data structures in python to solve problems.
- develop programs using object-oriented concepts.
- make use of python constructs to solve games.

List of Experiments

Exercise 1: Basics and operations

a) Write a python program to find sum of two numbers using command line arguments.

b) Write a Python program to compute distance between two points taking input from the user. Formula for Pythagorean theorem for compute distance between two points is: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Exercise 2: Selection Statements

a) Write a python program to test whether a given number is even or odd using if-else statement.

b) To calculate grade of students in python, you have to ask from user to enter marks obtained in 5 subjects and calculate the sum of all the marks and then average marks to find the grade according to the average marks obtained by student as shown in the given below:

Percentage	Grade
≥ 90	O
≥ 80 & < 90	A+
≥ 70 & < 80	A
≥ 60 & < 70	B+
≥ 50 & < 60	B
≥ 40 & < 50	C
< 40	F

c) Write a python program to print out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10 using for loop.

Exercise 3: Functions

a) Write a python program to compute cumulative product of a list of numbers (write function cumulative_product).

b) Write a python program that uses function to find the sum of the even-valued terms in the Fibonacci sequence whose values do not exceed ten thousand.

Exercise 4: Packages and Modules

a) Create and access a user defined package arithmetic package where the package contains a module named arithmeticdemo, which in turn contains a method called sumtwo() , subtwo(), multwo() and divtwo() which takes two numbers as parameter and returns the result.

b) Write a python program to compute GCD, LCM of two numbers (Each function shouldn't exceed one line use predefined module).

Exercise 5: Mutable and Immutable Data structures : Strings

a) Write a python program to accept a string from a user and re-display the same after removing vowels from it.

b) Write a python program to find mean, median, mode for the given set of numbers in a list.

c) Write a Python Program to count the number of characters in the string and store them in a dictionary.

Exercise 6: Object Oriented Programming Constructs

a) Write a python program to store the name and marks of students using classes. (Use list to store marks in 3 subjects).

b) WeCare insurance company wants to calculate premium of vehicles. Vehicles are of two types – "Two-Wheeler" and "Four-Wheeler". Each vehicle is identified by vehicle id, type, cost and premium amount. Premium amount is2% of the vehicle cost for two wheelers and 6% of the vehicle cost for four-wheelers. Calculate the premium amount and display the vehicle details. Write Python program to implement the class chosen with its attributes and methods.

Note: 1. Consider all instance variables to be private and methods to be public.

2. Include getter and setter methods for all instance variables.

Exercise 7: File Handling

To install the package pandas, write a python program to calculate the mean and standard deviation for list of numbers stored in excel file named data.xlsx. (Use Jupyter Notebook or Spyder tool in Anaconda Navigator)

Exercise 8: Game Playing-I

Write a python program to implement rolling a dice game.

Exercise 9: Game Playing-II

Write a python program to implement Water-Jug problem.

Exercise 10: Game Playing-III

Write a python program that uses functions to solve 8 queen's problems.

References Books

1. Reema Thareja, "Python Programming – Using Problem Solving Approach", Oxford University Press, 2014.
2. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson Education, 2017.
3. Elaine Rich, Kevin Knight, "Artificial Intelligence", 2nd edition, Tata McGraw Hill.

* * *

PROGRAMMING FOR CORPORATE
(Common to ECE, CSE, IT, AI&DS, IoT, CSE (AI&ML))
II Year – II Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Using JAVA

- Coding Standards / Best Practices
- Wrapper Classes, I/O Streams, Annotation
- Junit
- Multithreading | / II
- RDBMS / SQL / PL/SQL
- JDBC
- ANT
- HTML
- JavaScript / CSS
- Serviets and JSP
- XML-I and XML-II

MICROPROCESSORS AND MICROCONTROLLERS

III Year – I Semester

Lecture : 2	Practical : 2	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To familiarize with the architecture of 8086 processor & 8051 microcontroller and assembly language programming.
- To emphasize on the concepts of I/O Interfacing with 8086 and 8051.
- To familiarize with ARM architectures.

Course Outcomes

Upon successful completion of the course, the students will be able to

- summarize the architecture and instruction set of 8086 and 8051.
- develop the assembly language programs for 8086 and 8051.
- classify the interrupts and directives.
- develop applications for real world problems using 8086 and 8051
- explore the architectures of ARM processors

Course Content

UNIT – I: Architecture of 8086 Microprocessor

Difference between microprocessors and Microcontrollers, 8086 Architecture, register organization, memory organization, 8086 pin diagram: common function signals, minimum and maximum mode signals. Interrupts, Minimum mode and maximum mode based systems, interrupt structure, processing, timing diagrams.

UNIT – II: Assembly language of 8086& Interfacing

Addressing modes, classification of instructions, assembly directives, assembly language programming using data transfer, arithmetic, logical, branch, string instructions, string instructions etc. interfacing with memory & I/O, interfacing with 8255- stepper motor control.

UNIT – III: Architecture of 8051

8051 Architecture, Register organization, memory organization, ports, timers & serial communication, addressing modes, instructions set of 8051.

UNIT – IV: 8051 Applications

Interfacing with Key board, display devices: LED's, 7 segment display unit& LCD, A/D, D/A, Relays, Sensors.

UNIT – V: Introduction to ARM Architectures

What Is the ARM Cortex-M3 Processor? ARM and ARM Architecture 2: A Brief History, Architecture Versions, Instruction Set Development, The Thumb-2

Technology and Instruction Set Architecture, Cortex-M3 Processor Applications. Overview of the Cortex-M3:Fundamentals, Registers, Operation Modes, the Built-In Nested Vectored Interrupt, the Memory Map, the Bus Interface, the MPU, the Instruction Set, Interrupts and Exceptions, Characteristics Summary.

Text Books

1. D.V Hall, "Microprocessors & Interfacing", TMH, 2nd Edition, 2005.
2. Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, "The 8051 Microcontrollers and Embedded Systems", Pearson, 2ndEdition
3. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by JosephYou.

Reference Books

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Prentice Hall, 4th Edition, 2002.
2. Computer System Architecture, 3/e, M. Morris Mano, Pearson edition.
3. Kenneth. J. Ayala, Dhananjay V. Gadre, The 8051 Microcontroller & Embedded Systems Using Assembly and C, 1st edition, Cengage learning, 2010
4. K. Ray and K.M. Bhurchandani, "Advanced Microprocessors and Peripherals", TMH, 2nd edition, 2006.
5. Cortex -M3 Technical Reference Manual.

* * *

SENSORS, ACTUATORS AND DATA ACQUISITION

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To know the different Data acquisition systems and requirements for data analysis.
- To familiarize with, various types of sensors and actuators.
- To expose the design aspects of different actuators.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate data acquisition systems.
- differentiate the sensors, based on static and dynamic characteristics.
- interpret the principles of different sensors and actuators.
- describe the configuration and control of various actuators.

Course Content

UNIT – I: Data Acquisition System

Objectives of Data acquisition system, data loggers, single and multichannel data acquisition systems, sensor based data acquisition systems, electro mechanical A/D converter, Digital transducer.

UNIT – II: Mechanical and Electromechanical Sensors

Selection of a sensor, Acoustic Temperature Sensor, Thermometer – Resistance Change type Thermometric Sensors, Thermo-emf Sensors, Pyrometers, ultrasonic sensors.

UNIT – III: Magnetic Sensors

Introduction, principles, Hall Effect sensors, eddy current sensors, Angular/Rotary Movement Transducers – Synchros – Synchro-resolvers, electromagnetic flow meters, switching magnetic sensors, SQUID sensor.

UNIT – IV: Actuators

Classification of actuators, actuation systems, pneumatic and hydraulic systems, directional control valves, pressure control valves, cylinders, process control valves, rotary actuators.

UNIT – V: Actuation Systems

Mechanical and Electrical Actuation Systems:Types of motion, kinematic chains, cams, gears, ratchet and pawl, belt and chain drives, bearings, servo motors.

Text Books

1. D. Patranabis, “Sensors and Transducers”, PHI Learning Private Limited, 2nd Edition, 2006.
2. W. Bolton, “Mechatronics”, Pearson Education Limited, 3rd Edition, 2003.
3. H. S. Lalsi, “Electronic Instrumentation”, TMH, 3rd Edition, 2012.

Reference Books

1. D. Patranabis, “Sensors and Actuators”, PHI, 2nd Edition, 2013.
2. A.K sawhney “A Course in Electrical And Electronic Measurements And Instrumentation”, Dhanpatrai & Co., 2020.

* * *

DATA COMMUNICATION AND COMPUTER NETWORKS

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce the concepts of data communication, layered architecture, error detection, correction and data link layer protocols.
- To familiarise with the LAN architecture, routing algorithms, addressing schemes and higher layer protocols.

Course Outcomes

Upon successful completion of the course, the students will be able to

- interpret the general principles of data communication and their performance
- illustrate flow control, error control and LAN protocols.
- summarize the protocols, characteristics and different components at data link layer.
- design a small computer network with the given the working principles of LAN.
- compare higher layer protocols.

Course Content

UNIT – I: Data Communications

Data communications: Components, Data representation, data flow; **Networks:** Network criteria, physical structures; **Network Types:** LAN, WAN, Switching; **Protocol Layering:** Scenarios, Principles of protocol layering, logical connections; **TCP/IP Protocol suite:** layered architecture, layers in the TCP/IP protocol suite, description of each layer, encapsulation and de-capsulation, addressing; **The OSI Model:** OSI versus TCP/IP **; Performance:** bandwidth, throughput, latency, bandwidth – delay product; **Transmission Modes:** parallel and serial; circuit-switched network and packet switching.

UNIT – II: Data Link Layer

Introduction: Nodes, links, services, two categories of links, two sub-layers; **link-layer addressing:** three types of addresses, ARP; **Error detection and correction:** types of errors, redundancy, detection vs correction**; cyclic codes:** CRC, polynomials, cyclic code encoder using polynomials; **DLC services:** framing, flow and error control; **Data-link layer protocols:** simple protocol, stop-and-wait protocol, piggybacking; **Point-to-Point protocol:** services, framing, transition phases.

UNIT – III: Media Access Control

Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA; **Ethernet Protocol:** IEEE project 802; **Standard Ethernet:** Characteristics, addressing, access method, efficiency of standard Ethernet, implementation, changes in the standard; **Connecting devices:** hubs, link-layer switches, routers.

UNIT – IV: Network Layer

Network-layer services: packetizing, routing and forwarding; **network-layer performance:** delay, throughput, packet loss, congestion control, **IPv4 Addresses:** address space, class-ful and classless addressing; **Routing Algorithms:** distance-vector routing, link-state routing; **IPv6 Addressing:** Representation, address space, address space allocation.

UNIT – V: Higher Layer Protocols

Transport layer protocols: services, Go-Back-N, Selective-Repeat; **UDP:** port numbers, datagram, services; **TCP:** Services, features, segment, TCP connection, flow control, error control; **World Wide Web.**

Text Books

1. Behrouz A. Forouzan , "Data Communications and Networking" , 5th edition, McGraw Hill Education(I) Private Limited.

Reference Books

1. Andrew S Tanenbaum, "Computer networks", 4th edition, Pearson.
2. Mayank Dave, "Computer networks", 1st edition, Cengage.

* * *

Professional Elective - I

INTRODUCTION TO FOG COMPUTING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the concepts of fog computing.
- To explore the design issues of IoT through fog computing.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe the principles and architectures of fog computing.
- analyze different communication and management of fogs.
- demonstrate the storage and computation in fogs.
- design Internet of Things (IoT) applications through fog computing architecture.

Course Content

UNIT – I: Internet of Things (IoT) and New Computing Paradigms

Introduction, Relevant Technologies, Fog and Edge Computing, Completing the Cloud, Hierarchy of Fog and Edge Computing, Business Models, Opportunities and Challenges.

UNIT – II: Challenges in Federating Edge Resources

Introduction, Methodology, Integrated C2F2T Literature by Modeling Technique, Integrated C2F2T Literature by Use, Case Scenarios, Integrated C2F2T Literature by Metrics,Future Research Directions.

UNIT – III: Management of Network Slices and Optimization Problems in Fog Computing

Network Slicing in 5G, Network Slicing in Software, Defined Clouds, Network Slicing Management in Edge and Fog, The Case for Optimization in Fog Computing, Formal Modeling Framework for Fog Computing, Metrics, Optimization Opportunities along the Fog Architecture, Optimization Techniques.

UNIT – IV: Middleware for Fog and Edge Computing: Design Issues

Need for Fog and Edge Computing Middleware, Design Goals, State-of-the-Art, Middleware Infrastructures, System Model, Proposed Architecture, Case Study Examples, Fog Data Management, data analysis in fog- Architecture-Configurations.

UNIT – V: Applications and Issues

Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking, Fog Computing Model for Evolving Smart Transportation Applications, Testing Perspectives of Fog, Based IoT Applications.

Text Books

1. Buyya, Rajkumar, and Satish Narayana Srirama, eds, Fog and edge computing: principles and paradigms, 1st edition, John Wiley & Sons, 2019.
2. John MutumbaBilay , Peter Gutsche, Mandy Krimmel and Volker Stiehl, SAP Cloud Platform Integration: The Comprehensive Guide, 2nd edition, Rheinwerg publishing, 2019

Reference Books

1. Bahga, Arshdeep, and Vijay Madisetti. Cloud computing: A hands-on approach, 1st edition, CreateSpace Independent Publishing Platform, 2013.
2. OvidiuVermesan, Peter Friess, Internet of Things –From Research and Innovation to Market Deployment, 1 stedition,River Publishers, 2014

* * *

Professional Elective - I

INFORMATION THEORY AND CODING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the perception of information theory and Galois field.
- To familiarize basic concepts of linear block, convolution and BCH codes.

Course Outcomes

Upon successful completion of the course, the students will be able to

- compute efficiency of a communication system.
- compute Galois field arithmetic and Minimal Polynomials.
- investigate error detection and correction capabilities using linear block codes.
- design encoders and correct errors using decoders for RS and BCH codes.
- design encoders and correct errors using decoders for Convolutional codes.

Course Content

UNIT – I: Information theory & Source Coding

Mutual information and its properties. Shannon's theorem, Shanon-Fano coding, Huffman coding, efficiency calculations, Discrete memoryless communication channel -Model of discrete channel, Rate of information transmission over a discrete channel, capacity of a Gaussian channel, Shannon- Hartley theorem and its implications, bandwidth –S/N trade off.

UNIT – II: Introduction to Galois Field

Groups, Fields, Binary Field Arithmetic, Construction and properties of a Galois Field GF(2^m), Computations using GF(2^m) Arithmetic, Vector spaces, Matrices.

UNIT – III: Linear Block&Cyclic Codes

Introduction, matrix description of linear block codes, error detection and error correction capabilities of linear block codes, hamming codes, table look-up decoding using standard array, Binary cyclic codes, algebraic structure, encoding, syndrome calculation circuit and procedure, General form of decoder for cyclic codes, error correction procedure.

UNIT – IV: BCH Codes

Description of BCH codes -encoding and decoding and error correcting procedure, Iterative and simplified algorithm for finding the error location polynomial, Finding error location Numbers and Error Correction for BCH codes.

UNIT – V: Convolution Codes

Introduction, encoding of convolution codes, time domain approach, transform domain approach, graphical approach: state, tree and trellis diagram, Transfer function of Convolution code, Viterbi decoding algorithm, Sequential decoding, Comparison between block codes and convolution codes, Practical application of convolution codes.

Text Books

1. Shu Lin, D J Costello Jr., "Error Control Coding : Fundamentals and Applications", Second Edition, Pearson, 2010.
2. Sam Shanmugam "Digital and Analog Communication Systems", John Wiley, 2005.

Reference Books

1. Hwei Hsu, "Analog & Digital Communications", 2 nd Edition, Tata Mc. Graw Hill,2004.
2. J G Proakis, M. Salehi "Digital Communication", 4 th Edition, Tata Mc. Graw Hill,1999.
3. B.P. Lathi, "Modern Digital and Analog Communication systems", 3rd Edition,Oxford, 2010
4. K. Sam shanmugham, "Digital & Analog communications", Wiley,2008.

* * *

Professional Elective - I

DIGITAL SIGNAL PROCESSING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the basic concepts of discrete time signals and systems
- To introduce the concepts of Z-transform and frequency domain representation of discrete time signals.
- To familiarize with the designing of digital filters and their realization.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify various signals and systems, perform various operations on signals and process signals in the discrete domain.
- compute the Fourier series coefficients and Z-transform of discrete time signals.
- apply various transform techniques on discrete time signals.
- design IIR filters for a given specifications.
- categorize various techniques to design FIR filters and realize digital filters.

Course Content

UNIT – I: Discrete Time Signals and Systems

Discrete time signals - elementary discrete time signals, basic operations on sequences, classification, discrete time systems - classification, discrete time linear Time Invariant systems and their properties, convolution sum.

UNIT – II: Z-Transform and Discrete Fourier Series

Z Transform of sequence, properties of ROC, properties of Z transform, inverse Z transform- partial fraction method.

Discrete Fourier series: Fourier series for discrete time periodic signals, Fourier Transform for discrete time non-periodic signals, energy density spectrum, relationship of Fourier transform to Z transform, frequency response.

UNIT – III: Discrete Fourier Transform

Frequency sampling- Discrete Fourier Transform (DFT), properties of DFT, linear convolution of sequences using DFT, relationship between DFT and Z transform.

Fast Fourier Transforms (FFT): Fast Fourier Transform-Radix-2 (4 and 8 - Point) decimation in time and in frequency FFT algorithms, IDFT using FFT algorithms.

UNIT – IV: Design of IIR Filters

Analog filter approximation-Butterworth and Chebyshev (Type-I) filters, design of IIR filters from analog filters- Impulse Invariant technique, Bilinear transformation.

UNIT – V: Design of FIR Filters

Linear Phase FIR filters-frequency response, Fourier Series method of designing FIR filter, design of FIR filters using windows (Rectangular, Bartlett, Hamming, Hanning).

Realization of Digital Filters: Realization of IIR Filters**-** Direct form I, II; realization of FIR filters**-** transversal structure, cascade realization.

Text Books

1. John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications", Pearson Education / PHI, 2013.

Reference Books

1. A.V.Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", PHI.
2. Andreas Antoniou, "Digital Signal Processing", TATA McGraw Hill, 2006.
3. MH Hayes, "Digital Signal Processing", Schaum's Outline series, TATA Mc-Graw Hill, 2007.

* * *

Professional Elective - I

IOT FOR AGRICULTURE

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize the role of IoT in agriculture, issues and challenges in adopting IoT in agriculture.
- To analyse the importance of IoT in smart agriculture.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify the challenges of IoT based agricultural systems.
- summarise the hardware components of IoT based agricultural systems
- differentiate between the precision agriculture and traditional agriculture
- demonstrate the importance of IoT in crop management and smart irrigation.

Course Content

UNIT – I: IoT and Data Analytics in Smart Agriculture

Introduction, IoT ecosystem in agriculture, Benefits of IoT in agriculture, Open issues and key challenges in the adoption of IoT in agriculture, Legal issues in regulating AI in agriculture.

UNIT – II: Functional framework for IoT based agricultural systems

Architecture of smart farm monitoring system, Energy saving technologies, security mechanisms, Agricultural drones, Block diagram of IoT based agricultural systems, Flow diagram of controlling process of motor using sensors, IoT with transmitter and receiver wireless sensor model, Thingspeak cloud server.

UNIT – III: Precision Agriculture : Weather Forecasting for Future Farming

Terminologies in precision agriculture, Connection between precision agriculture and traditional agriculture, Weather and climate, Agricultural implications of climate change, Modern tools and techniques for precision agriculture – IoT – sensor technology – UAVs - UGVs.

UNIT – IV: Crop Management System Using IoT

Introduction, Crop management using IoT with Drones, Crop management using Raspberry Pi and Arduino, performance analysis.

UNIT – V: Smart Irrigation and Crop Security in Agriculture Using IoT

Applications, Methodology - Basic building blocks of an IoT device, Algorithms - Design flow, Implementation – System Process.

Text Books

1. Ajith Abraham, Sujata Dash, Joel J.P.C. Rodrigues, Biswaranjan Acharya, and Subhendu Kumar Pani, “AI, Edge and IoT-based Smart Agriculture”, Academic Press, Elsevier, 2021.

Reference Books

1. Megh R. Goyal, “Emerging Technologies in Agricultural Engineering” Apple Academic Press.
2. Kuhar, John. E. 1977. The precision farming guide for agriculturalist. Lori J. Dhabalt, USA
3. Curtis Johnson, “Process Control Instrumentation Technology”; 8th Edition, Pearson Education
4. Manual of Soil & Water conservation Engineering. Oxford & IBH Co. Sigma &Jagmohan, 1976.

* * *

SENSORS AND ACTUATORS LAB

III Year – I Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To acquaint the students with Virtual instrumentation for testing, control, and designing of sensor systems.
- To impart the knowledge about computer interfacing with sensors.

Course Outcomes

Upon successful completion of the course, the students will be able to

- measure statistical errors for analysis.
- characterisevarious sensors and actuators.
- interface peripherals with computer systems

List of Experiments

1. Perform basic measurements and data analysis for different sensors and actuators.
2. Characterize the temperature sensor (Resistance Temperature Detector)
3. Characterize the ultrasonic sensor.
4. Loading effect of potentiometer
5. Characteristics of load Cell .
6. Characteristics of Thermistor.
7. Characteristics of piezo electric transducer
8. Characteristics of Hall effect sensor
9. Simulate the performance of a chemical sensor(PH sensor)
10. Characterize the PIR sensor.
11. Characterize the temperature sensor (Thermocouple)
12. DC Motor Speed Control
13. Real-Time Data acquisition system(open ended experiment/virtual lab)

Reference Books

1. D. Patranabis, “Sensors and Transducers”
2. A. K. Shawney, “A course in Mechanical Measurements and Instrumentation”
3. Bela G. Liptak, “Instrument Engineers’ Handbook: Process Measurement and Analysis”

4. Doeblin, “Measurement Systems Applications and Design”
5. Renganathan. S,”Transducer Engineering”, 4th edition Allied Publishers, Chennai, 2003.

Useful links

1. http://www.maxim-ic.com/app-notes/index.mvp/id/4026
2. http://www.mstarlabs.com/sensors/thermocouple-cold-junctions.html
3. www.omega.com/techref/colorcodes.html
4. http://en.wikipedia.org/wiki/Thermocouple

* * *

DATA COMMUNICATIONS AND COMPUTER NETWORKS LAB

III Year – I Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To introduce the packet tracer simulator to build basic computer networks.
- To familiarize with the design of the computer networks using packet tracer.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify the different components, specifications of a computer and prepare the initial requirements to build a computer network.
- configure the end devices and network devices like computer, switch and router.
- assign the IP addresses for the components in the network using different addressing schemes.

List of Experiments

1. Computer Hardware and Specifications.
2. Preparation of straight and cross cables.
3. Creation of different topologies in packet tracer.
4. Network Representation and Initial Switch Configuration.
5. Configure initial router settings and connecting to a LAN.
6. Designing an IPv4 Network Subnetting Scheme.
7. Design an IP Addressing Scheme.
8. VLSM design and Implementation.
9. Configuration of IPv6 Addressing on the router and clients.
10. Configuration of secure passwords and SSH on router and switch.

Additional Experiments

1. Troubleshooting default gateway issues.
2. Testing network connectivity using ping and traceroute.

Reference Books

1. CCNA Routing and Switching ICND1 Official Cert Guide, Cisco Press.

Useful links

1. www.netacad.com

* * *

MICROPROCESSOR AND MICROCONTROLLERS LAB

III Year – I Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To introduce the assembly language programming concepts and interfacing with 8086 processorand 8051 microcontroller.

Course Outcomes

Upon successful completion of the course, the students will be able to

- interface I/O devices with 8086 Processor and 8051 microcontroller.
- develop various programs using 8086 microprocessor and 8051 microcontroller.

List of Experiments

Part A: Assembly Language Programming Exercises/Experiments using 8086

1. Implementation of simple hexa decimal, decimal arithmetic, and bit manipulation operations.
2. Implementation of code conversion between BCD, Binary, Hexadecimal and ASCII.
3. Implementation of searching and sorting of 8bit &16-bit numbers.
4. Implementation of String manipulations. Ex: Block transfer of data etc
5. Develop a stepper motor interface and write a program for rotating through any given sequence.
6. Develop a Digital-to-Analog Converter/Analog-to-Digital Converter interface and write a program.
7. Implementation of 2's complement and decoder functionalities using DIDO interface.

Part B: Assembly Language Programming Exercises / Experiments in 8051 using Keil

8. Develop a Program to interface seven segment display to port1 and port2 and display the count from 00 to FFH
9. Implement the functionality of traffic signal controller using 8051 microcontroller.
10. Develop a Program to display the given string on LCD.
11. Open ended Experiment/Virtual Lab

Reference Books

1. D. V. Hall, "Microprocessors and Interfacing", TMGH,2nd edition 2006
2. Barry B.Brey , "The Intel Microprocessors", PHI, 7thedition 2006.
3. M.A. Mazidi, J.G. Mazidi, R.D. Mckinlay, "The 8051 microcontroller and embedded systems",Pearson, 2nd Edition.

* * *

COMPETITIVE CODING
(Common to ECE, CSE, IT, AI&DS, IoT, CSE (AI&ML))

III Year – I Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Preparing Students for High-Eng Salary Packages - Training Modules are Dynamic in nature and change from time to time keeping the latest requirements of the industry in view.

- Training Modules will be decided THREE MONTHS before commencing the Semester.

Advance DS & Algorithm Analysis:

Linked Lists

- Introduction About Linked Lists.
- All Types(Single) And Its Operations.

Linked Lists

- Loop Detection In Linked List.
- Deletion Of Duplicates(Sorted And Unsorted),K Th Swapping Problem, Linkedlist Rotations

Stacks

- Introduction To Stacks And Its Operations And Applications, Stacks As Linked List And Stack As Array,
- Balancing Parenthesis, Expression Conversion - (Infix, Prefix, Postfix), Expression Evaluation (Infix, Prefix, Postfix)

Queues

Introduction To Queue And Its Operations And Applications, Queue As Linked List And As Array. Types Of Queue and Circular Queue, Priority Queue, Deque, Queue Implementation Using Stacks, Queue Programs

Trees

- Introduction To Trees And Its Applications, Tree Terminologies And Its Types. Binary Tree representations - array, Linked List, Tree representations - Full, complete, binary, skewed, Formulae.
- Tree Traversals (In order, Preorder, Postorder, and Level Order), Depth Of Tree.

- Binary Search Tree - Creation, Insertion(all types), BST construction from preorder, Binary tree to BST, array to BST(level order, preOrder), BST - deletion(all types), Traversals, all Standard Operations, BST Programs - LCA, node with min value, BST Programs (Doubts,Revision), Programs

Graphs

- Introduction To Graphs And Its Applications Graph Terminologies And Types Of Graphs Graph Representation Using Adjacency List And Matrix, Traversals (Bfs And Dfs).
- Path finding problems Floyds Tortoise and Hare algorithm In Graphs Programs, Graphs Programs(Doubts, Revision),

Greedy Algorithms

Introduction to Greedy algorithms, Activity Selection problem, Fractional Knapsack and Problems on Greedy algorithms

Dynamic Programming

Greedy vs Dynamic programming. Top down and bottom up approach, Longest Common Subsequence, longest increasing subsequence, Edit distance, 0-1 Knapsack, Coin change problem and Problems on dynamic programming.

EMBEDDED SYSTEM DESIGN

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize the elements of embedded systems.
- To impart the design skills of general purpose and single purpose processors.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify the core modules of an embedded system.
- design general purpose and application specific instruction set processors.
- design single purpose processors.
- demonstrate the differentstate machines and concurrent process models.

Course Content

UNIT – I: Introduction

Embedded system - definition, design challenge, processor technology, IC technology, Design Technology, Interfacing Basics – Timing diagrams, Hardware protocol basics, Interfacing with a general purpose processor, Arbitration.

UNIT – II: Elements of Embedded System

Purpose of embedded systems, Typical embedded system - Core of the embedded system, Memory, Sensors and Actuators. Communication Interface – device level communication interface – product level communication interface, Embedded firmware.

UNIT – III: General Purpose and Application Specific Instruction set Processors

Basic architecture, operation, Pipelining, programmer's view, development environment, Application Specific Instruction-Set Processors (ASIPs) – MicroControllers and Digital Signal Processors.

UNIT – IV: Custom Single Purpose Processors

Combinational logic, sequential logic, custom single purpose processor design, RT-level custom single purpose processor design, optimizing custom single purpose processors - Optimizing the original program - Optimizing the FSMD, Datapath and FSM.

UNIT – V: State Machine and Concurrent Process Models

Introduction, models Vs. languages, Texts vs. Graphics, An introductory example, Basic state machine model, finite state machines with data path model (FSMD), using state machines, HCFSM and statecharts language, program state machine model (PSM), Role of an appropriate Model and Language, concurrent process model.

Text Books

1. Frank Vahid, Tony D. Givargis, "Embedded System Design - A Unified Hardware/Software Introduction", John Wiley, 2002.
2. Introduction to Embedded Systems - Shibu.K.V, Tata McGraw Hill Education Private Limited, 2009.

Reference Books

1. Raj kamal, "Embedded Systems", TMH, 2nd Edition, 2008.
2. David E. Simon, An Embedded Software Primer, Pearson Education, 1999.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier Publications, 2005.
4. Prof.AnupamBasu, Embedded Systems Design, NPTEL, IIT Kharagpur, Jan. 2020.

* * *

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with the concepts of Artificial Intelligence and Machine Learning.

Course Outcomes

Upon successful completion of the course, the students will be able to

- discuss basic concepts of artificial intelligence
- apply the principles of knowledge representation and reasoning.
- learn about basics of machine learning and bayesian computational learning .
- utilize various machine learning techniques.
- express the concepts of neural networks.

Course Content

UNIT - I: Introduction

Definition of Artificial Intelligence, Evolution, Need, Applications in real world - Intelligent Agents-Agents and environments, Good Behavior, The nature of environments, Structure of agents, Heuristic search techniques.

UNIT - II: Knowledge–Representation and Reasoning

Knowledge Representation: Logical Agents, Patterns in Propositional Logic, Inference in First-Order Logic.

Reasoning: Probability, conditional probability, Bayes Theorem, Bayes Classifier.

UNIT - III: Introduction to Machine Learning

Towards Intelligent Machines, Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining.

UNIT - IV: Supervised and Unsupervised Learning

Supervised Learning: Decision Tree - Introduction, Example of a Classification Decision Tree, Measures of Impurity for Evaluating Splits in Decision Trees, ID3 Decision Tree.

Unsupervised Learning: Clustering-introduction, K-means, Hierarchical clustering.

UNIT - V: Learning With Neural Networks

Neuron Models- Biological Neuron, Artificial Neuron, Mathmatical Model, Feedforward Networks, **Perceptrons**- Limitations of Perceptron Algorithm for Linear Classification Tasks, Multi-Layer Perceptron (MLP) Networks and the Error-Backpropagation Algorithm.

Text Books

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2/e, Pearson Education, 2010.
2. M.Gopal, Applied Machine Learning, McGraw Hill Education.

Reference Books

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, 3/e, McGraw Hill Education, 2008.
2. Tom M. Mitchell, Machine Learning, McGraw Hill, 2013.
3. Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006.

* * *

WIRELESS SENSOR NETWORKS FOR IOT

III Year – II Semester

Lecture	: 2	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

- To impart the knowledge on wireless sensor networks.
- To familiarize the architecture, protocols of wireless sensor networks.

Course Outcomes

Upon successful completion of the course, the students will be able to

- summarize the concepts of network architecture.
- analyse the protocol design issues of wireless sensor networks.
- design routing protocols for wireless sensor networks with respect to protocol design issues.
- integrate wireless sensor networks to IoT.

Course Content

UNIT – I: Motivation for a Network of Wireless Sensor Nodes

Definitions and Background, Challenges and Constraints, Node architecture: The Sensing Subsystem, The Processor Subsystem, Communication Interfaces.

UNIT – II: Physical Layer

Basic Components, Source encoding, Channel encoding, Modulation, Signal propagation.

UNIT – III: Medium Access Control

Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols.

UNIT – IV: Network Layer

Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand.

Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols.

UNIT – V: Integration of WSN to IoT

Integration approaches – Stack-based approaches, Topology-based approaches - SCADA network architecture - Security Challenges.

Text Books

1. W. Dargie and C. Poellabauer, “Fundamentals of Wireless Sensor Networks”, Wiley, USA, 2010.
2. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005.

Reference Books

1. Ian F. Akyildiz, and Mehmet Can Vuran, “Wireless Sensor Networks”, Wiley, USA, 2010.
2. Feng Zhao and LeonidesGuibas, “Wireless Sensor Networks”, Elsevier Publication - 2002.
3. KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks Technology, Protocols, and Applications”, John Wiley, 2007.
4. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

* * *

VLSI SYSTEM DESIGN

III Year – II Semester

Lecture	: 2	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

- To make the students familiarize with IC layout preparation and its fabrication processes.
- To acquaint the students with combinational and sequential circuits designand itstesting.

Course Outcomes

Upon successful completion of the course, the students will be able to

- differentiatenMOS, CMOS and Bi-CMOS fabrication processes.
- inspect different design rules used in CMOS and BiCMOS process.
- design combinational and sequential circuits, and generating layouts for the same.
- apply testing techniques to identify manufacturing faults.

Course Content

UNIT – I: Introduction to MOS Technology

Basic MOS transistors, Enhancement mode transistor action, Depletion mode transistor action, nMOS fabrication, CMOS fabrication, p-well process, n-well process, Twin-tub process, BiCMOS technology.

UNIT – II: MOS and Bi-CMOS circuit design process

MOS layers, Stick diagrams – nMOS design style – CMOS design style, Design rules and layout – Lambda based design rules – Contact cuts – Double metal MOS process rules – CMOS lambda based design rules, general observations on the design rules, 2 µm Double metal, Double poly. CMOS / BiCMOS rules

UNIT – III: Subsystem design and layout generation for combinational circuits

Switch logic, Gate restoring logic, Examples of structured design – parity generator, bus arbitration logic – multiplexers – general logic function block – gray to binary code converter - programmable logic array (PLA).

UNIT – IV: Sequential circuits design and subsystem design processes

Some clocked sequential circuits - Two –phase clocking – charge storage – dynamic register element, some general considerations – An illustration of design

processes – 4 – bit arithmetic processor – design of a 4 – bit shifter, design of an ALU subsystem – design of a 4 – bit adder, implementing ALU functions with an adder.

UNIT – V: VLSI Testing

CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques, Design for testability, Practical design for test guidelines, Built-In-Self-Test.

Text Books

1. Kamran Eshraghian, Douglas A, Pucknell, and SholehEshraghian "Essentials of VLSI Circuits and Systems", Prentice Hall India, 2005.
2. Neil H E Weste and K. Eshraghian, "Principles of CMOS VLSI Design", Pearson Education, 1999.

Reference Books

1. Douglas A, Pucknell, Kamran Eshraghian, "Basic VLSI Design", 3rd Edition, Prentice Hall, l996.
2. John .P. Uyemura, "Introduction to VLSI Circuits and Systems", JohnWiley, 2003.
3. Wayne Wolf, "Modern VLSI Design", 3rd Edition, Pearson Education, 1997.
4. Prof. Sudeb Dasgupta, CMOS Digital VLSI Design, IIT Roorkee, NPTEL.

* * *

Professional Elective - II

WEARABLE COMPUTING

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To provide the basic concepts of wearable devices and supported technologies.
- To familiarize the concepts of implementation of IoT systems for wearable applications.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate the wearable devices and supported technologies.
- summarise the principles of wearable inertial sensors.
- apply the concepts of wearable computing in health care and other societal needs.
- identify the other wearable devices in wearable computing applications.

Course Content

UNIT – I: Role of IoT in Wearable Devices

Motivation for development of Wearable Devices, The emergence of wearable computing and wearable electronics, Smart connectivity and Big picture of IoT-smart devices, networks, Wireless technologies and need for data analysis. Evolution of wearable technology, Wearable IoT use cases- Smart watches , Android wear, Smart glasses, fitness trackers, health care devices, cameras, smart clothing etc.

UNIT – II: IoT Supported Technologies: Internet/Web And Networking Basics

OSI model, data transfer referred with OSI model, IP Addressing, point to point data transfer, point to multi point data transfer & network topologies, sub-nets, network topologies referred with web, introduction to web servers and cloud computing.

UNIT – III: Wearable Inertial Sensors

Wearable Inertial Sensors - Accelerometers, Gyroscopic sensors and Magnetic sensors; Modality of Measurement- Wearable Sensors, Invisible Sensors, In-Shoe Force and Pressure Measurement; Applications: Fall Risk Assessment, Fall Detection , Gait Analysis, Quantitative Evaluation of Hemiplegic and Parkinson's Disease patients. Physical Activity monitoring: Human Kinetics, Cardiac Activity, Energy Expenditure measurement: Pedometers, Actigraphs.

UNIT – IV: Wearable Computing Applications in Health Care

Wearable Blood Pressure (BP) Measurement: Cuff-Based Sphygmomanometer, Cuffless Blood Pressure Monitor. Study of flexible and wearable Piezoresistive sensors for cuffless blood pressure measurement. Wearable sensors for Body Temperature: Intermittent and Continuous temperature monitoring, Detection principles – thermistor, infrared radiation, thermopile, Modality of measurement wearable, adhesive/tattoo type. Conductive textile electrodes, Knitted Piezoresistive Fabric (KPF) sensors.

UNIT – V: Other Wearable Devices

Wearable devices with Global Positioning System (GPS) integration for tracking and navigation. Wearable Optical Sensors -chemical sensors, optical glucose sensors, UV exposure indicators, speech recognition using lasers; Photoplethysmography (PPG), 3D imaging and motion capture.

Text Books

1. "Seamless Healthcare Monitoring", Toshiyo Tamura and Wenxi Chen, Springer 2018
2. "Wearable Sensors -Fundamentals, Implementation and Applications", by Edward Sazonov and Michael R. Neuman, Elsevier Inc., 2014.
3. "Wearable and Autonomous Biomedical Devices and Systems for Smart
4. Environment", by Aimé Lay-Ekuakille and Subhas Chandra Mukhopadhyay, Springer 2010.

Reference Books

1. "Wearable Electronics Sensors - For Safe and Healthy Living", Subhas Chandra Mukhopadhyay, Springer 2015 ECE(BSW) Page 37
2. "Environmental, Chemical and Medical Sensors", by Shantanu Bhattacharya, A K Agarwal, NripenChanda, Ashok Pandey and Ashis Kumar Sen, Springer Nature Singapore Pte Ltd. 2018
3. M. Mardonova and Y. Choi, "Review of Wearable Device Technology and Its Applications to the Mining Industry," Energies, vol. 11, p. 547, 2018.
4. N. Luo, W. Dai, C. Li, Z. Zhou, L. Lu, C. C. Y. Poon, et al., "Flexible Piezoresistive Sensor Patch Enabling Ultralow Power Cuffless Blood Pressure Measurement," Advanced Functional Materials, vol. 26, pp. 1178-1187, 2016.
5. S. Yang, Y.-C. Chen, L. Nicolini, P. Pasupathy, J. Sacks, B. Su, et al., "Cut-and-Paste" Manufacture of Multiparametric Epidermal Sensor Systems," Advanced Materials, vol. 27, pp. 6423-6430, 2015.

* * *

Professional Elective - II

SOFT COMPUTING TECHNIQUES

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with different machine learning techniques.
- To impart knowledge on neural networks and decision tree learning.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe soft computing and its applications.
- design neural networks to simulate the way human brain analyzes and processes information.
- use fuzzy systems in information processing for classification and decision making.
- design genetic algorithms to find optimal or near optimal solutions to difficult problems.
- illustrate different kinds of hybrid systems used in soft computing.

Course Content

UNIT - I: Introduction

What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

UNIT - II: Neural Networks

What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons, Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map.

UNIT - III: Fuzzy Systems

Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

UNIT - IV: Genetic Algorithms

History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

UNIT - V: Hybrid Systems

Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

Text Books

1. S.Rajasekaran, G. A. Vijayalakshami, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI.
2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

Reference Books

1. Chin Teng Lin, C. S. George Lee, Neuro-Fuzzy Systems, PHI.
2. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.

* * *

Professional Elective - II

DIGITAL SYSTEM DESIGN USING HDL

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To impart the knowledge of behavior and RTL modeling of digital circuits usingVerilog.
- To familiarize with the design issues of digital applications.

Course Outcomes

Upon successful completion of the course, the students will be able to

- summarise the constructs and conventions of HDL.
- modeling the complex digital systems at several levels of abstractions.
- develop Behavioral and Register Transfer Level (RTL) models of Digital Circuits.
- design digitalapplications using HDL.

Course Content

UNIT – I:

Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools.

Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.

UNIT – II:

Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Design of Basic Circuit.

Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.

UNIT – III:

Behavioral Modeling: Introduction, Operations and Assignments, Functional Bifurcation, 'Initial' Construct, Assignments with Delays, 'Wait' Construct, Multiple Always Block, Designs at Behavioral Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, 'If' an 'if-Else' Constructs, 'Assign- De-Assign'

Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, Parallel Blocks, Force-Release, Construct, Event.

UNIT – IV:

Combinational and Sequential Blocks using Verilog: adders/subtractors (Full adder, carry look ahead adder, Parallel adder, Parallel adder cum subtractor), comparators, Decoders, encoders, multiplexers, counters (Synchronous, asynchronous counters), Universal shift Registers.

UNIT – V:

Digital Interfacing and Applications: Universal Asynchronous Receiver/ Transmitter (UART) in verilog, Serial Peripheral Interface (SPI) in verilog, vending Machine, Digital Clock, car parking sensor system, the home alarm system.

Text Books

1. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley2009.(Unit-I,II,III)
2. CemUnsalan,BoraTar"Digital System Design with FPGA Implementation Using Verilog and VHDL"McGraw-HillEducation,2017.(Unit-IV,V).

Reference Books

1. Fundamentals of Digital Logic with Verilog Design - Stephen Brown, ZvonkocVranesic, TMH, 2ndEdition.
2. Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning,2012.
3. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education,2009.
4. Advanced Digital Design with Verilog HDL - Michel D. Ciletti, PHI,2009.

* * *

Professional Elective - II

MICROCONTROLLERS FOR IOT PROTOTYPING

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce low power microcontrollers and to develop the skill set of programming low power sensing applications.
- To impart the knowledge of various peripheral related to sensing and communication using wired or wireless means.

Course Outcomes

Upon successful completion of the course, the students will be able to

- develop embedded programs using low power microcontrollers.
- develop communication system with sensor units.
- interface and deploy analog and digital sensors.
- design and develop IoT systems using Wi-Fi CC3200.

Course Content

UNIT – I: MSP430 Microcontrollers

Architecture of the MSP430, Memory, Central Processing Unit, Addressing modes, Exceptions: Interrupts and resets. Functions and subroutines, Mixing C and assembly language, Interrupts, Interrupt service routines, Issues associated with interrupts, Low power modes of operation.

UNIT – II: ARM Cortex MX Microcontroller

ARM Cortex M4: Introduction to architecture, programmers' model, Application Program Status Register, Memory System, Exceptions and Interrupts, Reset and Reset Sequence, Comparison of the instruction set in ARM Cortex-M processors.

UNIT – III: Display and Communication Modules

GPIO, LCD display, graphical display, relays, Peripheral programming SPI, I2C, UART, Zigbee controller.

UNIT – IV: Sensors Interfacing

Sensors interfacing techniques- Port Programming, ADC, SPI thermometer, I2C thermometer, PWM generation and demodulation, DTH11, single wire thermometer, Frequency counters.

UNIT – V: Microcontrollers for IoT

ESP8266, NodeMCU, TI-CC3200, Access point and station point mode, HTTP, MQTT, transmission and receiving, Intel-Gallileo boards.

Text Books

1. John H. Davies, “MSP430 Microcontroller Basics”, 2011, 2nd ed., Newnes publishing, NewYork.
2. Jacob Fraden, “Hand Book of Modern Sensors: physics, Designs and Applications”, 2014, 4thed., Springer, New York.

Reference Books

1. Joseph Yiu, “ARM CORTEX -M3 AND ARM CORTEX-M4processors” Third edition
2. Sergey Y. Yurish, “Digital Sensors and Sensor Systems: Practical Design”, 2011, 1st ed., IFSA publishing, New York.
3. Jonathan W Valvano, “Introduction to ARM Cortex –M3 Microcontrollers”, 2012, 5th ed.,Create Space publishing, New York.
4. Muhammad Ali Mazidi, Shujen Chen, SarmadNaimi, SepehrNaimi, “TI ARM Peripherals Programming and Interfacing: Using C Language”, 2015, 2nd ed., Mazidi and Naimi publishing, New York.

* * *

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB

III Year – II Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To familiarize with different search algorithms used in problem solving.
- To disseminate knowledge on different machine learning algorithms.

Course Outcomes

Upon successful completion of the course, the students will be able to

- develop programs on game search.
- build a decision tree.
- classify the data using Bayesian methods.
- classify various clustering methods and algorithms on data sets to create appropriate clusters.

List of Experiments

1. Implement A* Search algorithm.
2. Implement solution to water jug problem using heuristic search.
3. Write a program to implement Naive Bayes Classifier
4. Build a decision tree for Boolean functions.
5. Implement a program to generate decision tree on play tennis dataset.
6. Implement a program to calculate the distance between the data points using Euclidean distance method.
7. Implement a program to calculate the distance between the data points using Manhattan distance method.
8. Implement a program to calculate the distance between the data points using Minkowski distance method.
9. Demonstrate a program to perform clustering using k-means clustering algorithm.
10. Write a program to implement hierarchical clustering.
11. Build ANN for Boolean functions.
12. Build an Artificial Neural Network using Back propagation algorithm and test the same using appropriate data sets.

Reference Books

1. Elaine Rich, Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill edition, 2nd edition.
2. Stuart J. Russell, “Artificial Intelligence: A Modern Approach”, 2nd edition.
3. Tom M. Mitchell, “Machine Learning”, MGH.

* * *

IOT BASED EMBEDDED SYSTEMS LAB

III Year – II Semester

Practical: 4	Internal Marks : 15
Credits : 2	External Marks : 35

Course Objectives

- To familiarize with data logging, analysis and visualization using Internet of Things (IoT).
- To implement IoT based embedded systems for Agriculture, health monitoring, security and control applications.

Course Outcomes

Upon successful completion of the course, the students will be able to

- use modern tools to collect, analyse and visualize data from the sensors
- design and develop IoT based application for modern agriculture.
- design and develop IoT based health monitoring system.
- design and develop IoT based home automation and home security system.

List of Experiments

1. Signup Thing Speak platform, create a channel with multiple fields, and Publish data to the channel using MQTT Method.
2. Install and configure Mosquitto, a free open source MQTT broker.
3. Perform data analytics and data visualization using Thing Speak.
4. Use Temperature Sensor to detect environment temperature and turn the AC On and Off connected to a Relay.
5. Use DTH11 / equivalent sensor to measure the temperature and humidity in the atmosphere, and control the Solenoid Valve to stop/start the flow of water.
6. Use Pulse Oxymeter to measure Heart rate, Blood Oxygen level, Body temperature.
7. Develop a patient monitoring system using ESP32-CAM and Web server.
8. Use PIR motion sensor and Door Sensors / Servo motor sensors for Intruder detection.
9. Develop a home Security System using ESP32-CAM (Raspberry pi Camera) Which notify any intruder presence in home using mobile application.
10. Create a server in the IP address of the ESP32 Controller board and update the data generated from the MQ3 gas sensor in that Webpage.
11. Open Ended Experiment Using Thing Speak Platform and RaspberryPi hardware board.

Additional Experiments

1. Turn your smartphone into an IoT device using the IBM Watson IoT Platform cloud-hosted service.
2. Temperature and Humidity Logging using ThingSpeak.
3. Upload DHT11 sensor data to ThingSpeak channel through Raspberry pi2.
4. Upload Light sensor (TSL) data to ThingSpeak channel through Raspberry pi2.
5. Read Light Sensor data from ThingSpeak channel and store it into database through Raspberry pi2.
6. Control Home appliance like Lamp / Fan / TV etc., using ThingSPeak and IFTTT applet.

Reference Books

1. Colin Dow, "Internet of Things Programming Projects", 1st ed. Packt Publishing, 2018.
2. ThingSpeak Tutorial: https://www.mathworks.com/help/thingspeak/getting-started-with-thingspeak.html
3. Harry Fairhead, "Raspberry Pi IoT in C", I/O Press, Second Edition, October 2, 2020
4. NPTEL: Introduction to Internet of Things, Prof.SudipMisra, IIT Kharagpur, https://www.youtube.com/watch?v=3_JWl3zbIPo

* * *

LINGUISTIC COMPETENCY BUILDING
(Common to All Branches)

III Year – II Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

- Analytical skills
- Innovative and creative thinking
- A lateral mindset
- Adaptability and flexibility
- Level-headedness
- Initiative
- Teamwork
- Influencing skills
- Preparing professional resume
- Preparing for ivrs — Communication Skills evaluation tools like = VERSANT (pearson), SWAR(Aspiring Minds) Etc.

Elementary Statistics

- Mean, Median, Mode, Standard Deviation and Variance

Data Interpretation

- Tabular Data Interpretation
- Graphical Data Interpretation
- Pie Charts Data Interpretation

Simplifications & Approximations

- Simple Arithmetic Calculations

Usage of Language - Corporate Context

- Body Language and Professional Phrases
- Corporate etiquette
- protocol to be followed in Virtual Interview
- Online Meetings and Telephonic Interviews

ENGINEERING ECONOMICS AND PROJECT MANAGEMENT

IV Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To develop and can systematically apply an entrepreneurial way of thinking that will allow them to identify and create business opportunities that may be commercialized successfully.
- To explore the main factors for successful project management: project planning, project implementation & project evaluation and documentation.
- To work in or with new ventures either as venture capitalists, consultants to new firms or in new business development units of larger corporate.

Course Outcomes

Upon successful completion of the course, the students will be able to

- understand the importance of women entrepreneurship and problems of women entrepreneur.
- analyse entrepreneurship development programme, government policies, schemes and incentives for promotion of entrepreneurship and social responsibility of business.
- evaluate projects and make project report preparation.
- emphasize on creating a learning system through which management students can acquaint themselves with the special challenges of starting new ventures and design strategies for successful implementation of ideas.

Course Content

UNIT - I: Entrepreneurship

Importance, Characteristics and Qualities of Entrepreneurship- Entrepreneurship as a style of Management, Ethics and Social Responsibilities, Intrapreneur, Entrepreneur scenario in India and Abroad - case study.

UNIT - II: Role of Government

Role of IDBI, NIESBUD, SISI, DIC Financial Institutions, Commercial Banks, Entrepreneurial Development Institutes, Universities and other Educational Institutions offering Entrepreneurial Development Programme - case study.

UNIT - III: Training

Designing appropriate Training Programme to inculcate Entrepreneurial Spirit, Training for new and existing Entrepreneurs, Feedback and Performance of

Trainees. Women Entrepreneurship – Role & Importance, Profile of Women Entrepreneur, Challenges & Problems of Women Entrepreneurs, Achievements - case study.

UNIT - IV: Creativity

Innovation and Entrepreneurship, Planning and Development of Programmes, E-business Ventures; New Venture Management – The Changing Role of the Entrepreneur: Mid Career Dilemmas - case study.

UNIT - V: Planning and Evaluation of Projects

Growth of Firm - Factors inducing growth- Strategic investment – Growth rate decision – Project Feasibility Study – Financial Projections: how to do them the right way – MIS in Project- Project quality management techniques- Quality assurance. Problems & risks contingencies in managing International projects - case study.

Text Books

1. Hisrich: Entrepreneurship, TMH ,New Delhi, 2009.
2. Narayana Reddy: Entrepreneurship. Cengage learning, New Delhi, 2010.
3. Kenneth R.,Van Voorthis, Entrepreneurship and Small Business Management.

Reference Books

1. H.Nandan: Fundamentals of Entrepreneurship, PHI Learning, New Delhi, 2009.
2. Prasanna Chandra: Projects, TMH, New Delhi, 2009.
3. P.Gopala Krishnan & V.E Rama Moorthy , Project Management, MacMillan India.

* * *

ADVANCEMENTS IN IOT

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the advanced concepts in IoT.
- To familiarize the digital transformation in various fields with the advent of IoT.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate the advantages of edge computing.
- describe the concepts of various technologies in IoT
- analyze the digital transformation in IoT and future marketing
- identify the trust issues in IoT

Course Content

UNIT - I: Fundamentals of Edge Computing

Introduction, Edge Computing Architecture, Background Essentials: IoT Devices, Networking Architecture, Network Management and Control, Edge Computing State-of-the-Art Interfaces and Devices, Edge Computing Simulators, Research Directions.

UNIT - II: Future Technologies

Introduction, support for IoT Ecosystem creation, spurring innovation in lead markets, outlook

IoT vision, IoT strategic Research and Innovation Directions, IoT smart environments and applications, IoT and related future technologies, Networks and communications.

UNIT - III: Challenges in Digital Transformation

IoT Standardization, IoT security, IoT enabling the Digital Transformation of Industry, Case study - Farming Food and IoT: where we are going and challenges.

UNIT - IV: Future Marketing

Introduction, EU Initiatives and IoT Platforms for Digital Manufacturing, Digital Factory Automation, IoT Applications for Manufacturing, Future Outlook and Conclusions.

UNIT - V: Trust Management

The need for evaluating trust in IoT, Trust management in IoT, Trust for devices, Trust for IoT services, consent and trust in personal data sharing, using trust in authorization, using trust in an Indoor positioning system, using trust in routing.

Text Books

1. Edge computing: Fundamentals, Advances and Applications, K.Anitha Kumari, G.Sudha Sada sivam, D.Dharani, M.Niranjamurthy, CRC Press,Taylor Francis Group, 2022.
2. Digitising the Industry Internet of Things Connecting the Physical, Digital and Virtual Worlds, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publisher series.

Reference Books

1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”,Apress 2016.
2. Vijay Madisetti, Arshdeep Bahga,” Internet of Things A Hands-On- Approach”, 2014.

* * *

MOBILE APPLICATION DEVELOPMENT FOR IOT

IV Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To understand Android platform and write applications for Mobile devices.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe basic components of an integrated development environment and android software development kit(SDK)
- illustrate the Activity Life cycle methods and debugging the android applications
- creating User Interfaces with Layouts ,Widgets and Lists
- design Mobile Applications using images and Menus
- demonstrate Text files, SQLite Database, XML and Event handling mechanisms in android applications.

Course Content

UNIT - I: Installation and configuration of Development Platform

Installation and configuration of Development Platform: Installing Eclipse and Java, Installing The Android Development Kit

Your First Android Application :App Basics, Creating an Android Project , Navigating in Eclipse ,Laying Out the User Interface From Layout XML to View Objects ,Wiring Up Widgets ,Running on the Emulator , Android Build Process, Android build tools.

Android and Model-View-Controller :Creating a New Class ,Model-View-Controller and Android, Running on a Device, Adding an Icon.

UNIT - II: The Activity Lifecycle

The Activity Lifecycle: Logging the Activity Lifecycle, Rotation and the Activity Lifecycle, Saving Data Across Rotation, the Activity Life Cycle Revisited.

Debugging Android Apps: The DDMS Perspective :Exceptions and Stack Traces.

File Explorer, Android-Specific Debugging.

Android SDK Versions and Compatibility: Android SDK versions, Compatibility and Android Programming, Using the Android Developer Documentation.

UNIT - III: Creating User Interfaces with Layouts and Widgets

Creating User Interfaces with Layouts and Widgets: Screen Layouts and Main.xml file, XML Layout Attributes, Using the Graphical layout Tool.

Displaying Lists with List Fragment: Creating a List Fragment: List Fragment, List View and Array Adapter, Customizing List Items, Creating a Dialog Fragment, Parsing Data between Two Fragments, Challenge: More Dialogs.

UNIT - IV: The Action Bar

The Action Bar: Options Menu, Enabling Ancestral Navigation, an alternative Menu Item

Working with Images: Displaying Images, Using Images Stored on the Android Device, Key Class and Methods used in Image View

Intents: Adding Buttons, Using a Format String, Using Implicit Intents, Resolving an Implicit Intent

UNIT - V: Text Files, Data Tables and XML

Working with Text Files, Working with Data Tables Using SQLite, Using XML for Data Exchange, Key Classes and Methods: SQLite Database, Cursor, XML Pull Parser, XML Resource Parser.

Custom Views and Touch Events: Setting up the Drag and Draw Project, Creating a Custom View, Handling Touch Events.

Text Books

1. Android Programming (The Big Nerd Ranch Guide) by BRIAN HARDY & BILL PHILLIPS, Big Nerd Ranch, Inc. 2nd edition.
2. Android Application development for Java Programmers by James C. SHEUSI, Course Technology-Cengage Learning.

Reference Books

1. Wallace Jackson, Android apps for absolute Beginners .Apress.Third Edition
2. Wei-meng lee, wiley Beginning android 4 application development. Wrox Programmer to programmer.TM.
3. Zigurod Mednieks, Laired Dornin, G. Blake Meike & Masumi Nakameera, Programming Android: Java Programming for the New Generation of Mobile Devices, O Reilly. 2nd Edition.

Web-Links:

1. https://www.scribd.com/presentation/106732247/j2me-unit-4
2. https://developer.android.com/develop/index.html
3. http://www.edumobile.org/android/
4. https://developer.android.com/studio/intro/index.html

* * *

Professional Elective - III

BIO-MEDICAL ENGINEERING

IV Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with physiology of cardio-vascular system, muscle system and nervous system.
- To impart the knowledge on the biomedical signals, medical instruments and diagnostic techniques.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe the physiology of the human body and infer the principles of transducers for biomedical applications
- summarize the cardiovascular, respiratory, muscle and nervous system.
- demonstrate the recoding of the body vital signs and relating it to ICU and biotelemetry.
- demonstrate the working of modern diagnostic and therapeutic systems by using engineering principles.

Course Content

UNIT – I: Introduction to Human Physiology & Transducers

Man instrumentation system-introduction & components, physiological system of the body, sources of bio-electric potentials, resting & action potentials, types of bio-potential electrodes, principles of active and passive transducers, transducers for bio-medical applications.

UNIT – II: Electro Cardiogram

The heart & cardiovascular system, Physiology of respiratory system, Basic electrocardiography, ECG lead systems, ECG signal characteristics (parameters and their estimation), ECG amplifier, ECG interpretation, Phonocardiogram(PCG),

UNIT – III: Electro Myogram & Neurological Signals

Muscle classification, origin of EMG, motor unit action potential(MUAP), EMG signal characteristics, EMG recording systems, use and benefits of EMG, The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics (EEG rhythms, waves, and transients), Data acquisition and classification of sleep stages.

UNIT – IV: Biomedical Data Interpretation & Bio-Telemetry

Characteristics of medical data, Medical instrument, Elements of intensive care monitoring, blood pressure measurement, measurement of blood flow, pulse sensors Introduction & components of bio-telemetry system.

UNIT – V: Diagnostic Techniques & Therapeutic Equipment

Principles of ultrasonic measurement, Ultrasonic Imaging, Ultrasonic Diagnosis X-Ray & Radio-Isotope Instrumentations, CAT Scan, Emission Computerized Tomography, MRI, pace-makers, defibrillators, Respiratory Therapy Equipment.

Text Books

1. Onkar N. Pandey, Rakeshkumar, "Bio-Medical Electronics and Instrumentation", S. K. Kataria& Sons, 2007.
2. Biomedical Digital Signal Processing- Willis J. Tompkins, PHI 2001
3. Biomedical Signal Processing Principles and Techniques- D C Reddy, McGrawHill publications 2005.

Reference Books

1. Biomedical Signal Analysis-Rangaraj M. Rangayyan, John Wiley & Sons 2002
2. Cromewell, Wiebell, P.feiffer, "Biomedical instrumentation and measurements", Prentice-Hall, 1973.
3. Joseph J.Carr, John M.Brown, "Introduction to Bio-Medical Equipment Technology", Pearson Publications, 4th Edition.
4. Peter Konrad, "The ABC of EMG - A Practical Introduction to Kinesiological Electromyography" Version 1.0 April 2005.

* * *

Professional Elective - III

ARTIFICIAL NEURAL NETWORKS

IV Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with the basic concepts of neural networks fundamentals.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate ANN structure and activation functions.
- define foundations and learning mechanisms and state-space concepts.
- identify structure and learning of perceptions.
- explain feed forward, multi-layer feed forward networks and back propagation algorithms.
- analyze radial basis function networks and theory regularization.

Course Content

UNIT – I: Introduction

What is a neural network?, Human Brain, Models of a neuron, Neural networks viewed as directed graphs, Feedback, Network architectures, Knowledge Representation, Artificial Intelligence and neural networks.

UNIT – II: Learning Processes

Learning Process, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, Credit assignment problem.

UNIT – III: Single Layer Perceptrons

Introduction, Adaptive Filtering problem, Unconstrained Optimization techniques, Linear Least-squares filters, Least-mean square algorithm, Learning curves, Learning rate Annealing techniques, Perceptron, Perceptron convergence theorem.

UNIT – IV: Multilayer Perceptrons

Introduction ,some preliminaries**,** Back propagation algorithm, Summary of the Back propagation algorithm, XOR problem, Heuristics for making the Back propagation algorithm Perform Better, Output representation and decision rule, Feature Detection, Hessian matrix, Convolutional networks.

UNIT – V: Radial Basis Function Networks

Introduction, Cover's theorem on the separability of patterns, Interpolation problem, Regularization theory, Regularization networks, Generalized Radial Basis Function Networks , Approximation properties of RBF, Comparison of RBF networks and multilayer perceptrons.

Text Books

1. Simon Haykin, “Neural Networks: A comprehensive foundation”, Second Edition, Pearson Education Asia.
2. Satish Kumar, “Neural Networks: A classroom approach”, Tata McGraw Hill, 2004.

Reference Books

1. Robert J. Schalkoff, “Artificial Neural Networks”, McGraw-Hill International Editions, 1997.

* * *

Professional Elective - III

EMBEDDED REAL TIME OPERATING SYSTEMS

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the basic concepts of real time operating system, skills necessary to design and develop embedded applications.
- To acquaint the Unix/Linux and RT Linux basic concepts and programming.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply the concepts of real time operating system for embedded systems.
- develop system software for embedded systems using the design techniques.
- port RTOS on a microcontroller based development board.
- model real-time applications using Unix/Linux and RTLinux programming.

Course Content

UNIT – I: Introduction to Real Time Operating Systems

OS services, process management, timer functions, event functions, memory management, device, file and IO systems management, interrupt routines in RTOS environment and handling of interrupt source calls, Real-Time Operating Systems, basic design using an RTOS.

UNIT – II: Real Time Operating Systems

RTOS task scheduling models interrupt latency and response of the tasks as performance metrics, OS security issues, basic functions and types of RTOS for embedded systems, basic features of RTOS mCOS-II, Vx works, Windows CE and OSEK.

UNIT – III: Target Image Creation

Off-the-shelf operating systems, operating system software, target image creation for Windows XP embedded, porting RTOS on a micro controller based development board.

UNIT – IV: Programming in Linux & RT LINUX

Overview and programming concepts of Unix/Linux, shell programming, system programming – fork demo, semaphores and Mutex.

Overview of RT Linux, Core RT Linux API, program to display a message periodically, Semaphore management, Mutex management.

UNIT – V: Case Studies

Case study - digital camera hardware and software architecture, coding for sending application layer byte streams on a TCP/IP network using RTOS Vx works. Case study of embedded systems - for an adaptive cruise control system in a car and for a smart card.

Text Books

1. Rajkamal: "Embedded Systems-Architecture, Programming and Design", Tata McGraw Hill Publications, 2nd Edition, 2008.
2. Dr. K.V.K.K. Prasad: "Embedded/Real-Time Systems", Dream Tech Publications, 2003.

Reference Books

1. Jean J.Labrosse, "Embedding system building blocks", CMP publishers, 2nd Edition.
2. Rob Williams, "Real time Systems Development", Butterworth Heinemann Publication, 2006.

* * *

Professional Elective - III

IOT FOR INDUSTRIAL INSTRUMENTATION

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize the students with different types of cloud services.
- To impart the knowledge on IoT frame works and requirements for data analysis.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify the IoT physical devices and endpoints.
- demonstrate the concepts of IoT physical servers.
- apply the concepts of web API for IoT.
- analyze the various frameworks for IoT data analysis.

Course Content

UNIT – I: IoT Physical Devices and Endpoints

Basic building blocks of an IoT device, Raspberry pi interfaces, programming Raspberry pi with python, IoT devices, pcduino, beagle bone black, cubieboard.

UNIT – II: IoT Physical Servers

Cloud storage Models & communication APIS, WAMP-autobahn for IoT, xively cloud for IoT, Python web application framework- Django.

UNIT – III: Web API for IoT

Designing a RESTful web API, Amazon web services for IoT, Amazon EC2, Amazon auto scaling, Amazon s3, Amazon RDS, Amazon dynamo DB, Amazon kinesis, Amazon SQS, Amazon EMR.

UNIT – IV: Data Analytics for IoT

Apache hadoop, using hadoop map reduce for batch data analysis, Apache Oozie, Apache spark, apache storm.

UNIT – V: Case Studies

Using apache storm for real time data analysis, structural health monitoring case study, chef case study.

Text Books

1. Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On-Approach”, Arshdeep&Vijay Madisetti Publishers, 2014.

Reference Books

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Development Copyrights ,2014
2. Editors OvidiuVermesan Peter Friess,'Internet of Things – From Research andInnovation to Market.
3. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015.

* * *

Professional Elective - IV

CYBER PHYSICAL SYSTEMS

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To study the basic concepts, requirements, principles and techniques in emerging cyber-physical systems.
- To provide students of different disciplinary background with necessary knowledge to understand the fundamentals of cyber physical systems.
- To contribute to the development of new cyber-physical system applications; and stimulate research interest in this area.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify the IoT physical devices and endpoints.
- outline the traditional distributed systems, open systems, real-time systems, real-time embedded systems, control theory, and emerging cyberphysical systems
- demonstrate the challenges in emerging cyberphysical systems and to explore possible solutions from the perspectives of system specification
- identify the challenges in designing and development of cyber physical systems and discuss the differences among the different real time embedded systems.
- make use of the mathematics and computer science in real world computation interfaces.

Course Content

UNIT – I: Introduction to CPS & Its Characteristics

Introduction, CPS Characterisation, CPS Characteristics, Analysis of Representative CPS domains-CPS in manufacturing, Health care, Smart Grids, Transportation, Smart Cities.

UNIT – II: Adaptive Control in CPS

Introduction, Communication Channel of Multi Agent Systems, Cross Layer Design Resource Allocation for Distributed Control, Adaptive Quantisation, Adaptive Transmission Length, Data Harvesting Problem in CPS.

UNIT – III: Energy Harvesting Low Power Devices in CPS

Introduction, Background of CPS and Energy Harvesting Low Power sensors, Direct RF Energy Harvesting, Direct Energy Harvesting in Heterogenous Networks.

UNIT – IV: Challenges and Research Trends for Supporting Industrial Cps Applications

Introduction, Application Scenarios of 5G MTC in Industrial CPS applications, Summary of features and challenges of MTC traffic , Small Cell Based Scalable Network Architecture, 3GPP RA & Limitations, State of the art on RA procedure.

UNIT – V: Data Reliability Challenge of CPS

Transmission of Industrial Alarm messages & Future Trends in Industrial CPS, Age of social sensing in CPS and its overview, Review of State of the art, Outlook and Challenges, Need for Programming CPS.

Text Books

1. Houbing Song, Danda B. Rawat, Sabina Jeschke, Christian Brecher, "Cyber Physical Systems: Foundations, Principles and Applications ",Morgan Kaufmann Publishers, Aug 2016.
2. Raj Rajkumar and Dionisio De Niz," Cyber-Physical Systems", 1st Edition by Pearson India.

Reference Books

1. Syed Hassan Ahmed, Safdar Hussain Bouk , Dongkyun Kim, Mahasweta Sarkar ,Cyber Physical System Design with Sensor Networking Technologies.

URLs.

1. https://books.google.co.in/books?id=KgbpCgAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false.
2. https://digitallibrary.theiet.org/content/books/10.1049/pbce096e_ch2.

* * *

Professional Elective - IV

CLOUD COMPUTING

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To provide the architectural concepts of cloud computing.
- To familiarize with cloud service models and cloud based applications.

Course Outcomes

Upon successful completion of the course, the students will be able to

- understand different architectures and storage process in cloud.
- identify suitable cloud services to define cloud for the enterprise.
- demonstrate hardware level and OS level virtualization to implement virtual machines.
- design machine images, web applications and databases for virtual machines.
- apply data, network and host security for the cloud.

Course Content

UNIT – I: Cloud Computing

Introduction, cloud computing: What it is and what it isn't, from collaboration to the cloud : A short history of cloud computing, the network is the computer: How cloud computing works, understanding cloud architecture , storage, services; The pros and cons of cloud computing. Who benefits from cloud computing? who shouldn't be using cloud computing.

UNIT – II: Defining Clouds for the Enterprise

Storage-as-a-Service, Database as-a-Service, Information-as-a-Service, Process as-a-Service, Application- as-a-Service, Platform-as-a-Service, Security-as-a service, Infrastructure-as-a-Service.

UNIT – III: Virtual Machines and Virtualization

Implementation levels of virtualization: levels of virtualization implementation, VMM design requirements and providers, virtualization support at the OS level, virtualization structures/tools and mechanisms: Hypervisor and Xen architecture, binary transition with full virtualization, para- virtualization with compiler support.

UNIT – IV: Hardware Virtualization

Virtualization of CPU, memory and I/O devices: Hardware support for virtualization, CPU virtualization, memory virtualization, I/O virtualization.

Ready for the cloud: Web application design, machine image design, privacy design, database management: clustering or replication? primary key management, database backups.

UNIT – V: Security

Data Security: data control, encrypt everything, regulatory and standards compliance; Network Security: firewall rules, network intrusion detection; Host Security: system hardening, antivirus protection, host intrusion detection, data segmentation, credential management, Compromise response.

Text Books

1. Kai Hwang, Jack Dongarra and Geoffrey C.Fox, "Distributed and Cloud Computing: From Parallel Processing to the Internet of Things", 1st edition, Morgan Kaufman Publications.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud", 1stedition, O'Reilly.

Reference Books

1. Michael Miller, "Cloud Computing- Web Based Applications That Change the Way You Work and Collaborate Online", 1st edition, Que publications.
2. David S. Linthicum, "Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide" Addison Wesley.

* * *

Professional Elective - IV

DATA SCIENCE

IV Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with statistical methods to analyse data using classification, graphical and computational methods.
- To introduce Data Wrangling approaches and descriptive analytics on large data sets.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply Statistical learning methods to data for inferences.
- analyze data using Machine Learning approaches.
- illustrate Graphical Analysis and Hypothesis testing methods
- choose Data Wrangling approaches for pre-processing the data.
- erform descriptive analytics over massive data.

Course Content

UNIT – I: Introduction and Linear Regression

Statistical learning, assessing model accuracy, descriptive statistics,

Linear Regression: Simple and multiple linear regressions, k-nearest neighbor regression.

UNIT – II: Machine Learning

Modeling, Over-fitting and Under-fitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, Naive Bayes. Gradient Descent.

UNIT – III: Graphical Analysis & Hypothesis Testing

Visualizing Data: matplotlib, Bar Charts, Histograms and frequency polygons, box-plots, quartiles, scatter plots, heat maps, Simple Hypothesis testing, student's t-test, paired t and u test, correlation andcovariance, tests for association.

UNIT – IV: Data Wrangling

Data acquisition, the split-apply-combine paradigm.data formats, imputation. Cleaning and Munging, Rescaling, Dimensionality Reduction.

UNIT – V: Computational Methods& Analytical Processing

Programming for Eigen values and Eigenvectors, sparse matrices, QR and SVD.

Data warehousing and OLAP, data summarization, data de-duplication, data visualization using CUBEs.

Text Books

1. Gareth James, Trevor Hastie, Robert Tibshirani, Daniela Witten, “AnIntroduction to Statistical Learning with Applications in R”.Springer Publishing, 2013.
2. Joel Grus, “Data Science From Scratch”, OReilly Media, 2015

Reference Books

1. Mark Gardener, “Beginning R The statistical Programming Language”, Wiley.

* * *

Professional Elective - IV

ANALYTICAL IOT PLATFORMS

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce various IoT analytics for cloud.
- To familiarize with the strategies and techniques for IoT analytics.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe IoT analytics lifecycle and cloud paradigms.
- apply the big data, data science concepts in IoT.
- illustrate the IoT analytics with a case study i.e. smart building.

Course Content

UNIT – I: Introduction to IoT Analytics

Introduction, IoT Data and Big Data, Challenges of IoT Analytics Applications, IoT Analytics Lifecycle and Techniques, Cloud-based IoT Platform: IaaS, PaaS and SaaS Paradigms.

UNIT – II: IoT Analytics for the Cloud

Building elastic analytics, Elastic analytics concepts, Designing for scale, Cloud security and analytics, The AWS overview, Microsoft Azure overview.

UNIT – III: Collecting All That Data -Strategies and Techniques

Designing data processing for analytics, applying big data technology to storage, Apache Spark for data processing, to stream or not to stream, Handling change

UNIT – IV: Data Science & Data Organizing Strategies for IoT Analytics

Machine learning (ML) -Representation, Evaluation, optimization, Generalization, Deep learning.

Strategies to Organize Data for Analytics -Linked Analytical Datasets, managing data lakes, The data retention strategy.

UNIT – V: IoT Analytics in Smart Building: Case Study

Case study: overview of IoT analytics in smart building: Introduction, Addressing Energy Efficiency in Smart Buildings, A Proposal of General Architecture for Management Systems of Smart Buildings, IoT-based Information Management System for Energy Efficiency in Smart Buildings.

Text Books

1. Building blocks for IoT Analytics, John Soldatos, River Publishers (Units- I & V)
2. Analytics for the Internet of Things, Andrew Minteer, Packt Publishers (Units- II, III & IV)

Reference Books

1. The Internet of Things and Big Data Analytics Integrated Platforms and Industry Use Cases, Pethuru Raj, T Poongodi, Balamurugan Balusamy, Manju Khari, Auerbach Publications,2020
2. Internet of Things and Data Analytics Handbook, Hwaiyu Geng, Wiley,2015.

* * *

Professional Elective - V

SMART SENSORS

IV Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce the fundamentals of smart sensors and provides interfacing with embedded hardware.
- To gain knowledge of the latest developments in measurement and sensors.
- To expose with the various types of smart sensors.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify different types of smart sensor for iot applications
- apply signal conditioning circuit for sensor interface to digital computer.
- gain the knowledge required for interfacing the smart sensor.
- demonstrate the various packaging types of smart sensor.

Course Content

UNIT – I: Sensor Devices

Piezoresistive pressure sensor, Piezoresistive Accelerometer, Capacitive Sensing-Accelerometer and Microphone, Resonant Sensor and Vibratory Gyroscope, Low-Power, Low Voltage Sensors- Micro Electro Mechanical Systems Analysis and Design of MEMS Devices, Nano Sensors.

UNIT – II: Interfacing Sensor Information and MCU

Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion- MCU Control MCUs for Sensor Interface- Techniques and System Considerations- Sensor Integration.

UNIT – III: Control Techniques and Standards

Control of Sensors using - State Machines, Fuzzy Logic, Neural Networks, adaptive Control. Control Application using - CISC, RISC, DSP Control and IEEE 1451 Standards.

UNIT – IV: Communication for Smart Sensor

Wireless Data Communications- RF Sensing- Telemetry- Automotive Protocols-Industrial Networks, Home Automation- MCU Protocols.

UNIT – V: Packaging, Testing and Reliability Implications of Smart Sensors

Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors-Reliability Implications Testing Smart Sensors- HVAC Sensor Chip.

Text Books

1. Randy Frank, “Understanding Smart Sensors”, Artech House, Second Edition, 2011Boston.
2. Minhang Bao, “Analysis and design principles of MEMS devices”, Elsevier Publications, 2005,USA.

Reference Books

1. Nadim Maluf and Kirt Williams, “An Introduction to Micro Electro Mechanical Systems Engineering”, Second Edition, Artech House Publishers, June 2004, USA.
2. Gabriel M. Rebeiz, “RF MEMS: Theory, Design, and Technology”, Wiley-Inter science; 1st edition, 2002, UK.

* * *

Professional Elective - V

SYSTEM-ON-CHIP DESIGN

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the concept of System-On-Chip design technology.
- To introduce components in a typical SoC system.
- To familiarize with the concept of different processor cores.

Course Outcomes

Upon successful completion of the course, the students will be able to

- analyze various design issues of SoC.
- differentiate the various design methodologies for logic cores, soft and hard cores, memory and analog cores.
- perform SoC design validation, prototyping and verification.
- illustrate different core design examples.

Course Content

UNIT – I: Introduction to Architecture Designs

Architecture and design issues of SoC, hardware software co-design, co-design flow, core libraries, EDA tools and web pointers.

UNIT – II: Design Methodology for Logic Cores, Soft and Firm Cores

Logic Cores: SoC design flow, guidelines for design reuse and physical design. Soft and Firm Cores: Soft core design flow, design process for hard cores, sign-off checklist, deliverables and system integration.

UNIT – III: Design methodology for Memory Cores and Analog Cores

Memory Cores: Embedded memories and design methodology, specifications of analog circuits, circuit techniques, memory compiler, simulation models.

Analog Cores: Analog-to-digital converter, digital-to-analog converter, phase-locked loops, high speed circuits.

UNIT – IV: Design Validation

Core-level validation, core validation plan, test benches, core-level timing verification, core interface verification, protocol verification, gate-level simulation, SoC design validation, co-simulation, emulation, hardware prototypes.

UNIT – V: Core Design Examples

Micro processor cores, V830 R/AV super scalar RISC core, design of power PC603e G2 core, memory core generators, core integration and on-chip bus.

Text Books

1. Rochit Raj Suman, “System-on-a-chip: Design and Test”, Artech House, 2000.

Reference Books

1. Jason Andrews – Newness “Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) “, BK and CDROM.
2. Prakash Rashinkar, Peter Paterson and Leena Singh L “System on ChipVerification – Methodologies and Techniques”, Kluwer Academic Publishers,2001.
3. Ricardo Reis,”Design of System on a Chip: Devices and Components”, 1st Ed., Springer 2004.

* * *

Professional Elective - V

DATA WAREHOUSING AND DATA MINING

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the basic foundation towards the concepts of Data Mining and Preprocessing Techniques.
- To understand and apply various concepts of Association Rule Mining, Classification, Clustering Techniques and Algorithms**.**

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe fundamentals, and functionalities of data mining system and data preprocessing techniques.
- analyze the performance of association rule mining algorithms for finding frequent item sets from the large databases.
- outline the data classification procedure by selecting appropriate classification methods / algorithms.
- classify various clustering methods and algorithms on data sets to create appropriate clusters.
- apply appropriate web and text mining techniques for data analysis.

Course Content

UNIT – I: Introduction to Data Mining and Data Preprocessing

Introduction: What is Data Mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Major Issues in Data Mining.

Data Preprocessing: Data Cleaning, Data Integration, Data Reduction Data Transformation and Data Discretization, Data visualization, Data similarity and dissimilarity.

UNIT – II: Data Warehousing and OLAP

What is a Data Warehousing? Differences between Operational Databases Systems and Data Ware houses, Data Warehousing: A Multi-tiered Architecture, Data Warehouse Modeling: A Multidimensional Data Model, Star, Snowflake and Fact Constellations, a Role of Concept Hierarchies, OLAP Operations.

UNIT – III: Mining Frequent Patterns, Associations and Correlations

Basic Concepts: Frequent Itemsets, Closed Itemsets, and Association Rules, Frequent Itemset Mining Methods: Apriori Algorithm, Generating Association Rules from Frequent Itemsets, A Pattern-Growth Approach for Mining Frequent Itemsets.

UNIT – IV: Classification

Basic Concepts: What Is Classification, General Approach to Classification, Decision Tree Induction: Decision Tree Induction, Attribute Selection Measures-Information Gain, Gain Ratio, Bayes Classification Methods: Bayes' Theorem, Naïve Bayesian Classification, Rule-Based Classification: Using IF-THEN Rules for Classification, Lazy Learners: k-Nearest-Neighbor Classifier.

UNIT – V: Cluster Analysis

Cluster Analysis: Requirements for Cluster Analysis, Overview of Basic Clustering Methods, Partitioning Methods: k-Means, k-Medoids, Hierarchical Method: Agglomerative versus Divisive Hierarchical Clustering, Density-Based Method: DBSCAN. Grid-Based Method: STING.

Text Books

1. Jiawei Han, Micheline Kamber& Jian pei, "Data Mining Concepts and Techniques",3rdedition, Morgan Kaufmann Publishers an imprint of Elsevier.
2. Pang-Ning Tan, MichaelSteinbach, VipinKumar "Introduction to DataMining",1stedition, Pearson 2016.

Reference Books

1. Arun K Pujari ,"Data Mining Techniques", 3rd Edition, Universities Press.
2. Margaret H Dunham, "Data Mining Introductory and Advanced Topics", 1stedition, Pearson Education
3. T.VSveresh Kumar, B.EswareReddy, Jagadish S Kalimani," Data Mining Principles & Applications Elsevier.

* * *

Professional Elective - V

BIG DATA ANALYTICS

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To optimize business decisions and create competitive advantage with Big Data analytics.
- To introduce the architectural concepts of Hadoop, HDFS and Map Reduce paradigm.
- To introduce programming tools Pig , Hive in Hadoop echo system.

Course Outcomes

Upon successful completion of the course, the students will be able to

- illustrate the importance of big data and challenges of conventional systems.
- outline the building blocks of hadoop and basic file system operations.
- analyze data with hadoop Map Reduce framework.
- process the data in hadoop environment using Pig and Hive to solve real world and industrial problems.
- enumerate the open source frameworks used to efficiently store and process large data sets.

Course Content

UNIT – I: Introduction to Big Data

What is big data, Meet Hadoop – Data, Characteristics of Big Data , Data Storage and Analysis, Comparison with other systems: Relational Database Management Systems, Grid computing and Volunteer Computing.

UNIT – II: Hadoop and HDFS

Introduction to Hadoop, Brief history of Hadoop, Apache Hadoop eco system. The design of Hadoop Distributed File System (HDFS), Architecture, Building blocks of Hadoop: Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker, Basic File System Operations.

UNIT – III: Map Reduce

Java Map Reduce, Introduction to Weather Dataset, Analyzing weather data with UNIX tools, Analyzing weather data with Map and Reduce, Word Count Program using Map Reduce, Combiner Functions, Running a Distributed Map Reduce Job, Anatomy of a Map Reduce Job Run, Shuffle and Sort.

UNIT – IV: Pig - Hadoop Programming Made Easier

Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Uncovering Pig Latin structures, Looking at Pig

data types and syntax, Evaluating Local and Distributed Modes of Running Pig scripts, Checking Out the Pig Script Interfaces, Scripting with Pig Latin.

UNIT – V: Hive –A Data Warehouse in Hadoop

What is Hive? The Hive shell, Hive Services, The Metastore, Comparison with traditional Databases, HiveQL, Data types, Operators and Functions, Tables, Managed tables and External Tables, Partitions and Buckets, Importing data, Altering Tables, Dropping Tables,. Querying Data, Sorting and Aggregating, Joins, Subqueries, Views, What is UDF ? Types of Hive UDFs.

Text Books

1. Tom White, "Hadoop: The Definitive Guide", O'reilly Media, Fourth Edition, 2015.
2. Dirk deRoos, Paul C. Zikopoulos, "Hadoop for Dummies" John Wiley & Sons, Inc., 2014.

Reference Books

1. Paul Zikopoulos, Chris Eaton, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st edition, TMH.
2. Chuck Lam, "Hadoop in Action", 1st edition, Manning Publications.

Web Links

1. Hadoop:http://hadoop.apache.org/
2. Hive:https://cwiki.apache.org/confluence/display/Hive/Home
3. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html

* * *

MOBILE APPLICATION DEVELOPMENT FOR IOT LAB

IV Year – I Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To understand the components and structure of mobile application development frameworks for Android OS based mobiles.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply basic and important design concepts and issues of development of mobile applications.
- summarize the capabilities and limitations of mobile devices.
- develop mobile applications using Android Studio.

List of Experiments

1. Develop an application that uses GUI components, Font and Colours. Display a text message on the screen and add two buttons on the screen, which upon clicking will change the colour and font of the text displayed.
2. Develop an application that uses Layout Managers and event listeners. Display GUI components and place on screen using different layouts available.
3. Develop a native calculator application. The calculator is required to perform the basic operations: Addition, Subtraction, Multiplication and Division. Display necessary buttons on the calculator.
4. Write an application that draws basic graphical primitives on the screen. Write the code to draw rectangle, Square, circle and a line, using different fonts and colours.
5. Develop an application that makes use of database. Create an employee database using SQLite database. Perform the following operations on the database: (i) Add, (ii) Delete, (iii) Modify and (iv) View, using android application and display the details of employees on the screen.
6. Develop an application that makes use of RSS Feed. RSS (Rich Site Summary; originally RDF Site Summary; often called Really Simple Syndication) uses a family of standard web feed formats to publish frequently updated information: blog entries, news headlines, audio, video).Add permissions to access Internet in manifest file.

7. Implement an application that implements Multi threading. Take three threads and upon clicking a button START MULTITHREAD, display their execution on the screen.
8. Develop a native application that uses GPS location information. Write the required code and add a button on the screen SHOW LOCATION. Upon clicking the button, the location details such as longitude and latitude need to be displayed.
9. Implement an application that creates an alert upon receiving a message. Create a questionnaire that includes questions and multiple choice answers. Upon selecting an answer, an alert need to be displayed on the screen, whether the answer is correct or wrong.
10. Write a mobile application that creates alarm clock. The alarm need to be displayed with the following operations: (i) Set an alarm, (ii) Alarm message is to be displayed at target time (iii) Off an alarm. Each operation must display an alert message to the user, on the screen.

Text Books

1. Brian Hardy & Bill Phillips, Android Programming (The Big Nerd Ranch Guide), Big Nerd Ranch, Inc. 2nd edition.
2. Pradeep Kothari , "Android Application Development", Kogent Learning Solutions Inc. Dream Tech Publishers.

Reference Books

1. James C. SHEUSI , Android Application development for Java Programmers, Course Technology-Cengage Learning.

* * *

ARM PROGRAMMING FOR IOT

IV Year – I Semester

Practical: 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To Develop and test embedded C programs using ARM7TDMI/LPC2148.
- To Conduct the experiments on an ARM7TDMI/LPC2148 evaluation board with external/internal I/O devices.

Course Outcomes

Upon successful completion of the course, the students will be able to

- develop and implement applications using Embedded C language for ARM7TDMI/LPC2148 microcontroller.
- interface circuits with microcontroller using GPIOs and develop C code.
- develop and implement C code to generate different waveforms using DAC.

List of Experiments

1. Basic Arithmetic Operations
2. ASCII to BCD Conversion
3. Reading Switch status and Display on LED
4. Traffic light control
5. Stepper Motor Control
6. 4X4 Keyboard and LCD interfacing
7. Interfacing ADC
8. Interfacing DAC
9. Sensor Interfacing
10. Zigbee protocol Implementation
11. Open ended experiment/Virtual Lab.

Reference Books

1. Atul P.Godse," ARM Controller: ARM Fundamentals, LPC2148 CPU and Peripherals", Technical Publications
2. Stephen B Furber , "ARM system on chip Architecture", Pearson Publications, 2nd edition.

* * *

Open Elective - I

ELEMENTS OF CIVIL ENGINEERING

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce basics of Civil Engineering concepts in the fields of surveying, building materials, water resources, Water Supply, Sanitary, Electrical Works in Building and Highway Engineering.

Course Outcomes

Upon successful completion of the course, the students will be able to

- familiarize with basics of civil engineering.
- carryout various civil engineering survey works.
- identify the various properties of building materials and various types of buildings.
- get acquainted with fundamentals of Water Resources, Water Supply, Sanitary and Electrical Works in Building.
- enumerate the fundamental concepts highway engineering.

Course Content

UNIT - I: Introduction

Introduction of Civil Engineering, Scope of Civil Engineering, Role of Civil Engineer in Society. Impact of infrastructural development on economy of country.

UNIT - II: Surveying and Leveling

Introduction: Definition of Surveying, Fundamental principles of surveying, Classification of surveying.

Linear Measurement: Methods, Instruments used in chain surveying, Selection of stations, Chaining and Ranging

Angular Measurement: Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing local attraction.

Leveling: Objectives and applications-terminology-Instruments,component parts of dumpy level, Types of leveling, levelling staff.

UNIT - III: Building Materials and Construction

Materials: Introduction to construction materials - Stones, Bricks, Lime, Cement, Timber, Sand, Aggregates, Mortar, Concrete and bitumen.

Construction: Classification of buildings, Building components and their functions.

UNIT - IV: Water Resources, Water Supply, Sanitary and Electrical Works in Building

Hydrologic cycle, water use and its conservation, Introduction to dams, barrages and check dams.

Introduction, water supply system, water supply layout of a building, housedrainage, traps, electrical works in building.

UNIT - V: Transportation Engineering

classification of roads, Introduction of flexible and rigid pavements, Introduction to road traffic and traffic control mechanism.

Text Books

1. Elements of Civil Engineering, Mimi Das Saikia, Bhargab Mohan Dasand Madan Mohan Das Publisher: PHI Learning Private Limited New Delhi.
2. Basic Civil Engineering, Dr. B.C Punmia,Ashok.K. Jain and Arun K. Jain: Laxmi Publications,Delhi.
3. Surveying Vol. I, Dr. B. C. Punmia, Ashokkumar Jain, ArunkumarJain, 17th Edition Publisher: Laxmi Publications ,Delhi.

Reference Books

1. Surveying and Leveling, R. Subramanian, Publisher: Oxford University.
2. Building drawing, M.G.Shah, C.M.Kale and S.Y.Patki Publisher: TataMcGraw Hill.

* * *

Open Elective - I

ENVIRONMENTAL LAWS AND POLICIES

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To equip the students to have a basic awareness on environmental and socioeconomic Factors.
- To impart the knowledge of environmental pollution problem.
- To elucidate the rules and regulations of patents and trade laws.

Course Outcomes

Upon successful completion of the course, the students will be able to

- comprehend different moral perspectives and one's own Ethical standards.
- understand the concept of safety and risk.
- explain different initiatives to protect nature.
- identify the role of Environmental Engineering.
- understand different types of infringement of Intellectual Property Rights.

Course Content

UNIT - I: Introduction

Introduction to trade and environment - International environmental laws, Right to Environment as Human Right, International Humanitarian Law and Environment, Environment and conflicts management, Famous international protocols like Kyoto.

UNIT - II: Environmental Laws

Overview of environment, Nature and eco system, Concept of laws and policies, Origin of environmental law, Introduction to environmental laws and policies, Environment and Governance, Sustainable development and environment, Understanding climate change, Carbon crediting, Carbon foot print etc.

UNIT - III: Air and Noise Pollution Control Laws

Air pollutants, Sources, classification, Combustion, Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects-Smoke, Smog and ozone layer disturbance, Greenhouse effect. Air sampling and pollution measurement methods, Principles and instruments, Overview of air pollution control laws and their mitigation measures. Sound power, Sound intensity and sound pressure levels; Plane, Point and line sources, Multiple sources; Outdoor and indoor noise propagation;

Psychoacoustics and noise criteria, Effects of noise on health; Special noise environments: Infrasound, Ultrasound, Impulsive sound and sonic boom; Noise standards and limit values; Noise instrumentation and monitoring procedure, Noise control methods.

UNIT - IV: Water Quality Laws

Introduction to water quality laws development, calibration and verification cost: benefit analysis using models, Laws for estuary and lakes, Waste water treatment legislation; Introduction to water quality management systems and procedures, Consequence Analysis; Socioeconomic aspects, Measures of effectiveness of pollution control activities.

UNIT - V: Environmental Impact Assessment and Life Cycle Analyses

Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; Rapid EIA and comprehensive EIA; General framework for environmental impact assessment, Characterization and site assessment. Environmental Risk Analysis, Definition of risk, Matrix method - Checklist method, Fault tree analysis, Environmental Audit: Cost Benefit Analysis; Life Cycle Assessment; Resource balance, Energy balance & management review; Operational control; Case studies on EIA.

Text Books

1. Kuehn, T.H., Ramsey, J.W. and Threlkeld, J.L., Thermal Environmental Engineering, 3rd Edition, Prentice Hall, 1998.
2. A Textbook of Environmental Chemistry, by O. D. Tyagi and M. Mehra
3. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, economical and Working Environment, 120th ASEE Annual Conference and Exposition.

Reference Books

1. Larry W. Canter, “Environmental Impact Assessment”, 1st edition, McGraw-Hill (international edition).
2. David P. Lawrence, “Environmental Impact Assessment - Practical Solutions to Recurrent Problems”, 1st Edition, Wiley-Interscience.
3. Advanced Air and Noise Pollution Control, Lawrence K. Wang, Norman C. Pereira, Yung-Tss Hung, 2005 Edition, Humana Press.
4. Municipal Solid Waste Management, P. Jayarami Reddy, 1st Edition, B.S. Publications.

* * *

Open Elective - I

ELECTRICAL MATERIALS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the concepts of dielectric and ferro-magnetic materials.
- To impart knowledge on semiconductor materials, materials used in batteries and solar cells.
- To familiarize the materials required for specific electrical applications.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe the properties of liquid, gaseous and solid dielectric materials used in electrical applications.
- analyze the properties of Ferro electric, Peizo electric and Pyro electric materials.
- classify different magnetic materials and examine the effects of aging and impurities on magnets.
- elucidate various semiconductor materials and their applications in integrated circuit.
- choose appropriate material for a given electical and special purpose application.

Course Content

UNIT - I: Dielectic Materials

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics.

UNIT - II: Ferromagnetic Materials

Properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials, applications of Ferro-electric materials.

UNIT - III: Magnetic Materials

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, Magnetostriction, magnetically soft and hard materials, ageing of magnets, Superconductivity and its origin, Zero resistance and Meissner Effect.

UNIT - IV: Semiconductor Materials

Properties of semiconductors, Classification of Semiconductors, Silicon wafers - Wafer manufacturing process, Resistor, Fabrication processes of MOSFET on IC.

UNIT - V: Materials for Electrical Applications

Materials used for Resistors, rheostats, heaters, stranded conductors, fuses, electric contact materials, Solid Liquid and Gaseous insulating materials. Effect of moisture on insulation, Testing of Transformer oil as per ISI standards - Galvanization methods, Materials for battery and solar cells.

Text Books

1. R K Rajput: A course in Electrical Engineering Materials, Laxmi Publications. 2009.
2. David Linden, Thomas B. Reddy "The Handbook of Batteries" McGraw-Hill Hand Books 2010.
3. T K BasaK: A course in Electrical Engineering Materials:, New Age Science Publications 2009.

Reference Books

1. TTTI Madras: Electrical Engineering Materials
2. Adrianus J.Dekker: Electrical Engineering Materials , THM Publication

* * *

Open Elective - I

CONTROL SYSTEMS ENGINEERING

II Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To equip the students with the basic concepts of control systems by developing mathematical models for physical systems.
- To familiarize with the time domain behavior of linear control systems.
- To impart knowledge on analytical methods to quantify stability of linear control systems.
- To introduce the state space analysis to continues time systems.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply the basic concepts and properties of feedback control systems for mathematical modeling of physical systems.
- explore the transfer function analysis using singal flow graph representation of control systems.
- employ the time domain analysis to quantify the performance of linear control systems and specify suitable controllers.
- perform frequency domain analysis of control systems required for stability analysis.
- use the concept of state variable theory to determine the dynamic behavior of linear control systems.

Course Content

UNIT - I: Introduction

Concepts of Control Systems- Open loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer function for physical systems.

UNIT - II: Control Systems Components

Transfer Function of DC Servo motor - AC Servo motor -, Block diagram representation of systems considering -Block diagram algebra – Representation by signal flow graphs - Reduction is using Mason's gain formula.

UNIT - III: Time Response Analysis

Standard test signals - Time response of first order systems – Characteristic equation of feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.

UNIT - IV: Stability Analysis in S-Domain

The Concept of Stability – Routh's Stability Criterion – Qualitative Stability and Conditional Stability –Limitations of Routh's Stability.

Root Locus Technique: The root locus concept - construction of root loci – simple problems.

UNIT - V: State Space Analysis of Continuous Systems

Concept of state, state variables and state model, derivation of state models from physical systems, solving the Time invariant state equations- State Transition Matrix and its Properties, concept of controllability and observability.

Text Books

1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International Limited Publishers, 6th edition, 2017.
2. Automatic control system – B.C.Kuo , john wiley and son's 8th edition, 2003.

Reference Books

1. Modern control engineering – K.Ogata , prentice Hall of India Pvt. Ltd., 5th Edition, 2015.
2. Control system – N.K.Sinha, New Age International (p) Limited Publishers, 3rd Edition, 1998.
3. Control system engineering – Norman S-Nice, Willey Studio Edition, 4th Edition. Feed back and control system – Joseph J Distefa.
4. Modern control systems - Richard C. Dorf and Robert H. Bishop, Pearson Prentice Hall Publications, 12th Edition, 2010.

* * *

Open Elective - I

AUTOMOTIVE ENGINEERING

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce various components and sub systems of an automobile.
- To impart knowledge on various safety systems of an automobile and emission norms.

Course Outcomes

Upon successful completion of the course, the students will be able to

- outline the various components and sub systems of an automobile.
- specify different safety norms for the operation of an automobile.

Course Content

UNIT - I:

Introduction: classification of automobiles, components of four wheeler automobile-chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive.

Fuel supply systems: Simple fuel supply system in petrol and diesel engines. working of simple carburettor, direct fuel injection system in diesel engine.

UNIT - II:

Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

UNIT - III:

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

UNIT - IV:

Suspension System: Objectives of suspension system, front suspension systemrigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

UNIT - V:

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

Text Books

1. Kirpal Singh, "Automobile Engineering Vol-1 & vol-2", Standard Publishers Distributors, 14 th edition, 2017 .
2. William H Crouse & Donald LAnglin, Automotive Mechanics, Tata Mc Graw Hill Publications, 10th edition, 2017.

Reference Books

1. R.B Gupta , Automobile Engineering, Satya Prakashan Publications, 6th edition,2016.
2. Newton steeds & Garrett, "The Motor vehicle", Society of Automotive Engineers, 13th edition,2001.
3. G.B.S. Narang, "Automobile Engineering", Khanna Publishers, 5th edition, 1995.

* * *

Open Elective - I

ELEMENTS OF MECHANICAL TRANSMISSION

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the principles of mechanical power transmission elements.

Course Outcomes

Upon successful completion of the course, the students will be able to

- choose suitable shaft couplings for a given application.
- propose suitable transmission element for a given application.
- identify suitable power screw for motion transmission.

Course Content

UNIT - I: Shaft Couplings

Shaft couplings: Rigid couplings – muff, split muff and flange couplings, flexible coupling-modified flange coupling.

UNIT - II: Belt Drives

Flat Belts: Introduction, selection of a belt drive, types of belt drives, length of belts, materials, belt joints, types of flat belt drives, power transmitted.

UNIT - III: V-Belt, Rope Drives & Chain Drives

V-belts: Introduction, Types of V-belts, ratio of driving tensions for V-belt, power transmitted.

Rope Drives: Introduction, classification of rope drives, power transmitted.

Chain drives: Introduction, chain drives, polygonal effect, selection of roller chains, length of chain.

UNIT - IV: Power Screws

Forms of threads, multi-start threads, right hand and left hand threads, nut, compound screw, differential screw.

UNIT - V: Gears and Gear Trains

Types, terminology, materials, law of gearing, velocity of sliding, forms of teeth, path of contact, arc of contact, interference, gear Trains - types, differential of an automobile.

Text Books

1. Bhandari, “Design of Machine Elements”, Tata McGraw Hill book Co.,5th Edition, 2020.
2. P.C. Sharma & D.K. Agarwal, “Machine Design”, S.K.Kataria & Sons ,13th Edition, 2018.

Reference Books

1. Sharma & Purohit, “Design of Machine Elements”, PHI, 10th Edition,2011.
2. Kannaiah, “Design of Machine Elements”, Scitech Publications, 2nd Edition, 2015.

* * *

Open Elective - I

INTRODUCTION TO EMBEDDED SYSTEMS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the classification, characteristics, applications of embedded systems.
- To provide clear understanding about the role of firmware in correlation with hardware systems.
- To familiarize with the architecture of 8051 microcontroller.

Course Outcomes

Upon successful completion of the course, the students will be able to

- compare embedded and general computing systems.
- select the processors for an embedded system application.
- understand the architecture and instruction set of 8051 microcontroller.
- program the timers/counters and serial communication components of 8051 microcontroller.

Course Content

UNIT - I: Introduction to Embedded Systems

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT - II: Typical Embedded System: Core of the Embedded System

Elements of Embedded Systems, General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT - III: Embedded Firmware

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT - IV: Introduction to 8051 Microcontroller

Overview of 8051 microcontroller, Architecture, I/O Ports, Memory organization, Addressing modes and Instruction set of 8051, Simple programs.

UNIT - V: 8051 Real Time control

Interrupts- 8051 Interrupts, Interrupt Vector table of 8051, IE Register, IP register;Timers and Counters-Timer 0, Timer 1, TMOD Registers, TCON Register,Mode1 Programming; Serial Port- SBUF, SCON Registers, Doubling baud rate using PCON register, program for serial data transmission.

Text Books

1. K.V Shibu, "Introduction to Embedded System", TMH Education private limited, 2009.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontrollers and Embedded Systems", 2nd Edition, Pearson Education.

Reference Books

1. Kenneth. J. Ayala, Dhananjay V. Gadre, "The 8051 Microcontroller & Embedded Systems Using Assembly and C", 1st edition, Cengage learning, 2010.
2. Rajkamal," Embedded Systems" 2nd Edition, TMH, 2008.
3. Frank Vahid, Tony Givargis, "Embedded System Design", 2nd Edition, John Wiley Publishers.

* * *

Open Elective - I

FUNDAMENTALS OF COMMUNICATION SYSTEMS

II Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce various analog and digital modulation and demodulation techniques
- To familiarize with various multiplexing schemes and cellular telephone systems

Course Outcomes

Upon successful completion of the course, the students will be able to

- understand the concepts of basic communication system
- compare different multiplexing techniques.
- differentiate DSB-SC, SSB and frequency modulation schemes.
- distinguish ASK, PSK and FSK modulations.
- know the concepts of the cellular telephone systems

Course Content

UNIT - I: Introduction to Communication Systems

Introduction, Communication Process: Elements of communication system, Concept of Bandwidth and frequency spectrum, Sources of information: Classification of signals, Baseband and Band pass signals, Communication channels, Classification of communication systems.

UNIT - II: Basic Models of Communication

Need of modulation, Different types of modulation systems, Multiplexing, Basic Models of Communication. Primary Communication Resources, Survey of communication applications, Analog and digital signals, Conversion of analog signals to digital signals, electromagnetic spectrum (EM) Spectrum.

UNIT - III: Linear Modulation

Basics of Amplitude Modulation: Definition and Physical Appearance, Single tone an AM wave, Frequency Spectrum and Bandwidth of an AM wave, Modulation Index, Power distribution in an AM wave; Forms of an AM signal (theoretical concepts): Double Side Band-suppressed Carrier (DSB-SC), Single Side Band (SSB).

UNIT - IV: Angle Modulation

Basics of Frequency Modulation: Definition and Physical Appearance, Frequency Deviation Curve, Equation of FM wave, Frequency Deviation, Modulation Index, Deviation Ratio; Comparison of FM and AM Signals.

Phase Modulation: Definition and Physical Appearance, Equation of PM wave.

UNIT - V: Digital Transmission

Digital communication system model, advantages and disadvantages of digital communication, pulse code modulation (PCM), ASK, FSK, PSK, Basics of cellular telephone systems.

Text Books

1. Wayne Tomasi, “Electronics Communication systems”, Pearson Education, 5th edition, 2004.
2. Dr. Sanjay Sharma, "Communication Systems: Analog and Digital", Katson Books, 7th Reprint Edition, 2018.

Reference Books

1. Simon Haykin, John Wiley, “Principles of Communication Systems”, 2nd Edition, John Wiley & Sons.
2. V. Chandra Sekar, "Analog Communication", Oxford University Press, 2010.
3. Dr. Sanjay Sharma, "Digital Communications", Katson Books.
4. B.P.Lathi, “Modern Analog and Digital Communication”, 3rd Edition, Oxford reprint, 2004.

* * *

Open Elective - I

INFORMATION RETRIEVAL SYSTEMS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce basic concepts in information retrieval.
- To familiarize with applications of information retrieval techniques in the Internet or Web environment.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify the basic theories in information retrieval systems.
- use inverted file as an index data structure to retrieve the documents from the database.
- create signature files for fast retrieval of text data.
- build PAT treesand PAT arrays for the given text document.
- use stemming algorithms to improve the performance of IR systems.

Course Content

UNIT - I: Introduction to Information Storage and Retrieval System

Introduction, Domain Analysis of IR systems and other types of Information Systems, IR System Evaluation. Introduction to Data Structures and Algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

UNIT - II: Inverted files

Introduction, Structures used in Inverted Files, Building Inverted file using a sorted array, Modifications to Basic Techniques.

UNIT - III: Signature Files

Introduction, Concepts of Signature Files, Compression, Vertical Partitioning, Horizontal Partitioning.

UNIT - IV: New Indices for Text

PAT Trees and PAT Arrays: Introduction, PAT Tree structure, algorithms on the PAT Trees, Building PAT trees as PATRICA Trees, PAT representation as arrays.

UNIT - V: Stemming Algorithms

Introduction, Types of Stemming Algorithms, Experimental Evaluations of Stemming to Compress Inverted Files.

Text Books

1. Frakes W.B., Ricardo Baeza-Yates, “Information Retrieval Data Structures and Algorithms”, Prentice Hall, 1992.
2. Ricardo Baeza-Yates, Bertheir Ribeiro-Neto, “Modern Information Retrieval”, Pearson Education.
3. Robert Korfhage, “Information Storage & Retrieval”, John Wiley & Sons.

Reference Books

1. Kowalski, Gerald, Mark T Maybury, “Information Retrieval Systems-Theory and Implementation”, Kluwer Academic Press, 1997.
2. Information retrieval Algorithms and Heuristics, 2nd edition, Springer.

* * *

Open Elective - I

COMPUTER GRAPHICS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To emphasize on functionalities of various graphic systems and geometric transformations
- To familiarize on visible surface detection methods and computer animations.

Course Outcomes

Upon successful completion of the course, the students will be able to

- outline different graphical display devices and drawing algorithms.
- illustrate different 2-D geometrical transformations on graphical objects
- interpret different line and polygon clipping algorithms
- infer different 3- D transformations and viewing functions on objects.
- summarize different surface detection methods and computer animations

Course Content

UNIT - I: Introduction

Introduction: Application of computer graphics, raster scan and random scanDisplays.

Filled Area Primitives: Points and lines, inside and outside tests, line drawing algorithms, Scan line polygon fill algorithm.

UNIT - II: 2-D Geometrical Transforms

Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transformations.

UNIT - III: 2D Viewing

The viewing pipeline, window to view-port coordinate transformation, Cohen-Sutherland line clipping algorithm, Sutherland – Hodgeman polygon clipping algorithm.

UNIT - IV: 3D Geometric Transformations

Translation, rotation, scaling, reflection and shear transformations, composite transformations, types of projections.

UNIT - V: Visible Surface Detection Methods and Animation

Classification – types, back-face detection, depth-buffer, BSP tree, area sub-division method.

Animations: General computer animation, raster animation, key frame systems, Graphics programming using Open GL .

Text Books

1. Donald Hearn, M. Pauline Baker, "Computer Graphics *C* version", 2nd e edition, Pearson Education.
2. Francis S.Hill, Stephen M. Kelley, "Computer Graphics using Open GL", 3rd edition, Pearson Education.

Reference Books

1. Foley, VanDam, Feiner, Hughes, "Computer Graphics Principles and Practice", 2nd edition, Pearson Education.
2. Rajesh K Maurya, "Computer Graphics with Virtual Reality Systems", Wiley.

* * *

Open Elective - I

SYSTEM SOFTWARE

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the implementation details of assemblers, loaders, linkers, and macro processors.

Course Outcomes

Upon successful completion of the course, the students will be able to

- outline the relationship between system software and machine architecture.
- analyze working of assembler for a simplified Instructional computer.
- describe the important features of linkage Editors and Dynamic Linking .
- identify the mostly used macro processors algorithms and data structures.
- compare the functions of Absolute Loader , Bootstrap Loaders.

Course Content

UNIT - I: Introduction

System software and machine architecture, The Simplified Instructional Computer (SIC), Machine architecture, Data and instruction formats, addressing modes, instruction sets, I/O and programming System.

UNIT - II: Assemblers

Basic assembler functions, SIC assembler, assembler algorithm and data structures, machine dependent assembler features.

UNIT - III: Implementation of Assemblers

Instruction formats and addressing modes, program relocation, machine independent assembler features, literals, symbol, defining statements, expressions, one pass assemblers, multi pass assemblers, implementation example, MASM assemble.

UNIT - IV: Loaders & Linkers

Basic loader functions, design of an absolute loader, simple bootstrap loader, machine dependent loader features, relocation, loader options, program linking, algorithm and data structures for linking loader, linkage editors, dynamic linking, implementation example.

UNIT - V: Macro Processors

Basic macro processor functions, macro definition and expansion, macro processor algorithm and data structures, machine independent macro processor features, concatenation of macro parameters, generation of unique labels, conditional macro expansion.

Text Books

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rd edition, Pearson Education Asia, 2000.

Reference Books

1 D. M. Dhamdhere, "Systems Programming and Operating Systems", 2nd Revised edition, Tata McGraw-Hill, 1999.

2. John J. Donovan "Systems Programming", Tata McGraw-Hill Edition, 1972.

* * *

Open Elective - I

FREE & OPEN SOURCE SOFTWARE

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the opportunities for open source software in the global market.
- To familiarize with different steps in implementing the open source.

Course Outcomes

Upon successful completion of the course, the students will be able to

- state the need and applications of open source software.
- compare and Contrast between Open source and commercial software
- demonstrate LINUX operating systems concepts.
- create database in MYSQL and perform operations on it.
- design and develop a web application using PHP.

Course Content

UNIT - I: Introduction

Introduction to Open sources, Need of Open Sources, Advantages of Open Sources and Application of Open Sources.

UNIT - II: LINUX

LINUX Introduction, General Overview, Kernel Mode and user mode, Process, Advanced Concepts-Personalities, Cloning, Signals.

UNIT - III: PHP

PHP- Introduction, Programming in web environment, variables, constants, data types, operators Statements, Arrays.

UNIT - IV: MySQL

MySQL: Introduction, Setting up account, Starting, terminating and writing your own SQL programs, Record selection Technology, Working with strings, Date and Time, Generating Summary, Working with metadata.

UNIT - V: Advanced PHP

OOP–String Manipulation, PHP and SQL database, PHP Connectivity, Debugging and error handling.

Text Books

1. M.N.Rao, “Fundamentals of Open Source Software”, PHI Learning.
2. Steve Suchring,”MySQLBible”, John Wiley, 2002

Reference Books

1. Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications, 2003.

* * *

Open Elective - I

FUZZY MATHEMATICS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the knowledge of fuzzy set theory and its applications in Engineering.

Course Outcomes

Upon successful completion of the course, the students will be able to

- state the need and applications of open source software.
- distinguish between crisp set and fuzzy set.
- know different operations on fuzzy relations.
- use defuzzification methods to crisp sets.
- draw inferences using fuzzy logic.
- develop membership value assignments.

Course Content

UNIT - I: Classical Sets And Fuzzy Sets

Classical sets – Operations – Properties. Fuzzy sets – Operations – Properties – membership functions - Features of the membership function.

UNIT - II: Fuzzy Relations

Fuzzy Cartesian product and composition - Fuzzy relations - Operations - Properties of fuzzy relations - Fuzzy tolerance and equivalence relations.

UNIT - III: Fuzzification And Defuzzification

Fuzzification - defuzzification to crisp set - Defuzzification to scalars (centroid method, centre of sums method, mean of maxima method).

UNIT - IV: Fuzzy Logic

Classical logic – Fuzz logic – Approximate reasoning ["if ... then" approach and "if ... then ....else" approach] – Other forms of the implication operation.

UNIT - V: Development Of Membership Functions

Membership value assignments – Inference – Rank ordering – Neural networks – Genetic algorithms – Inductive reasoning.

Text Books

1. Timothy J.Ross., Fuzzy Logic with Engineering Applications - Second Edition, Wiley Publications, 2015, New Delhi.

2. S.Rajasekaran, G.A.Vijayalakshmi Pai, Neural networks, Fuzzy logic, and genetic algorithms synthesis and applications- – Prentice-Hall of India private limited, 2008, New Delhi.

Reference Books

1. H.J. Zimmarman, Fuzzy set theory and its applications, 4th edition — Springer, 2013. New Delhi.
2. S.Nanda and N.R.Das "Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi.

* * *

Open Elective - II

REMOTE SENSING AND GIS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the basic concepts and principles of Remote Sensing.
- To familiarize with structure and function of Geographic Information Systems.
- To illustrate the multidisciplinary nature of Geospatial applications.

Course Outcomes

Upon successful completion of the course, the students will be able to

- relate the scientific theories to the behaviour of electromagnetic spectrum
- distinguish between different types of satellites and identify appropriate remote sensing data products for mapping, monitoring and management applications
- interpret Satellite images and processed outputs for extracting relevant information
- structure the concept of a spatial decision support system in its analog and digital forms
- list and elaborate applications of Remote Sensing and GIS in various fields

Course Content

UNIT - I: Electro-Magnetic Radiation (EMR), Its Interaction with Atmosphere & Earth

Definition of remote sensing and its components – Electromagnetic spectrum, wavelength regions important to remote sensing, wave theory, particle theory, Stefan-Boltzmann and Wien's Displacement Law – Atmospheric scattering, absorption, atmospheric windows, spectral signature concepts, typical spectral reflective characteristics of water, vegetation and soil.

UNIT - II: Platforms and Sensors

Types of platforms, orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors, resolution concept, payload description of important Earth Resources and Meteorological satellites – Airborne and Space-borne TIR (Thermal Infrared Radiation) and microwave sensors.

UNIT - III: Image Interpretation and Analysis

Types of Data Products – types of image interpretation, basic elements of image interpretation, visual interpretation keys – Digital Image Processing, pre-processing, image enhancement techniques – multispectral image classification, supervised and unsupervised.

UNIT - IV: Geographic Information System

Introduction to Maps, definitions, map projections, types of map projections, map analysis – GIS definition, basic components of GIS, standard GIS software's – Data types, spatial and non-spatial (attribute) data - Data models – Data input - measurement scales – Data Base Management Systems (DBMS).

UNIT - V: RS and GIS Applications

Land cover and land use classification, crop productivity and crop monitoring, Smart city applications, Forest fire detection using image analysis.

Text Books

1. Remote Sensing and Image Interpretation by Thomas. M. Lillesand and Ralph. W. Kiefer,7th Edition, John Wiley and Sons, 2015.
2. Remote Sensing and Geographical Information Systems by M. Anji Reddy, 4th Edition, B.S. Publications.

Reference Books

1. Remote Sensing and GIS by Basudeb Bhatta, 2nd Edition, Oxford University Press.
2. Principles of Geographical Information Systems by Burrough P.A. and Rachel A. Mc Donell,3rd Edition, Oxford Publication, 2016.

* * *

Open Elective - II

GREEN BUILDING TECHNOLOGY

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the different concepts of sustainable design and green building techniques.
- To explore the techniques available of best fit for the specific construction project.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe the concepts of sustainable design and green building techniques
- understand the energy efficiency and indoor environmental quality management
- explain the energy efficiency techniques and concepts of embodied energy
- apprise the drawings and models of their own personal green building project
- select the Indoor Environmental Quality and comfort

Course Content

UNIT - I: Introduction to Green Buildings

Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

UNIT - II: Site Selection and Planning

Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

UNIT - III: Energy Efficiency

Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone

depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT - IV: Green Building Materials

Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management.

UNIT - V: Occupant Comfort and Wellbeing

Daylighting, air ventilation,exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc. Suggested.

Text Books

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, New Age International, New Delhi.

Reference Books

1. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
2. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
3. Green Building Fundamentals by Mike Montoya, Pearson, USA, 2010.
4. Sustainable Construction – Green Building Design and delivery by Charles J. Kibert, John Wiley &Sons, New York, 2008.
5. Sustainable Construction and Design by Regina Leffers, Pearson/ Prentice Hall, USA, 2009.

* * *

Open Elective - II

MODELING AND SIMULATION OF ENGINEERING SYSTEMS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with programming skills using basic MATLAB and its associated tool boxes.
- To impart knowledge on building SIMULINK and Graphical user interface

Course Outcomes

Upon successful completion of the course, the students will be able to

- create, modify and work with variables and its related operations
- develop MATLAB program to solve real time engineering problems.
- solve and visualize the dynamic performance of engineering systems through MATLAB plotting features.
- compute and analyze the numerical data of a physical system using advanced features in MATLAB.
- analyze the performance of physical system using toolboxes and GUI.

Course Content

UNIT - I: Introduction to MATLAB

Getting Started, MATLAB as language, MATLAB windows-Direct and Indirect windows, and Functions of Windows, MATLAB Environment, File Types, Inputting and Outputting methods.

UNIT - II: Variables, Scripts and Functions

Making Variables, Manipulating Variables, Vectorization, Scripts, , creating and working with scripts, Basic Functions, creating and working with function files, Flow Control-if, for, while and switch cases, Signal routing-break, continue and return, examples with engineering applications.

UNIT - III: Plotting

Basic Plotting, 2D Plotting – line, bar, area; 3D plotting-mesh and surface; plotting types - Multiple plotting, Sub plotting; Line styles, examples with engineering applications.

UNIT - IV: Solving Equations and Curve Fitting

Linear Algebra, Polynomials, Optimization, Differentiation / Integration, Differential Equations, Probability and Statistics, Data Structures, Images and Animation, Debugging, examples with engineering applications.

UNIT - V: Toolboxes and GUIs

Introduction to Neural networks, Fuzzy logic, Control systems, Symbolic Math, Simulink, File I/O, Graphical User Interfaces, examples with engineering applications.

Text Books

1. Getting started with MATLAB-A quick introduction for scientists and engineers, Rudra Pratap, Oxford University Press, January, 2010.
2. MATLAB and SIMULINK for Engineers, Agam Kumar Tyagi, Oxford University Press, 2012.

Reference Books

1. Introduction to MATLAB, Spencer, R.L. and Ware, M, Brigham Young University, available online accessed, May, 2008.
2. An introduction to MATLAB, David F. Griffiths, The University of Dundee, available online, accessed, October 2012.
3. MATLAB an introduction with applications, Amos Gilat, Wiley publications, January 2012.

* * *

Open Elective - II

POWER SYSTEMS ENGINEERING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the working of various types of power plants and layout of substations.
- To familiarize the concepts of corona, insulators and various tariff methods.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe the operation of thermal power station.
- illustrate the operation of hydro power plants.
- identify various components and their role in the operation of nuclear power plant
- distinguish various bus bar arrangements and insulators used in substation
- analyze the phenomenon of corona and describe various tariff methods.

Course Content

UNIT - I: Thermal Power Stations

Single line diagram of Thermal Power Station showing paths of coal, steam, water, air, ash and flue gasses-Brief description of TPS components: Economizers, Boilers, super heaters, Turbines ,condensers, chimney and cooling towers.

UNIT - II: Hydro Power stations

Selection of site, block diagram approach of hydro electric power plant and classification of pumped storage power plants.

UNIT - III: Nuclear Power Stations

Working principle, Nuclear fuels. Nuclear reactor Components: Moderators, Control roads, Reflectors and Coolants. Types of Nuclear reactors and brief description of PWR, BWR and FBR.

UNIT - IV: Air insulated substations

Equipments used in substations, Types of Insulators, Classification of substations: - Indoor & Outdoor substations: Single line diagram of substation. Bus bar arrangements and their classification.

UNIT - V: Corona and Tariff Methods

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss.

Tariff Methods: Simple rate, Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods.

Text Books

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd., 1999.
2. A Textbook of Power System Engineering by Er.R k Rajput, Laxmi Publications ,2nd Edition, 2015.

Reference Books

1. Principles of Power Systems by V.K Mehta and Rohit Mehta S.Chand& Company Ltd.New Delhi 2004.
2. Generation Distribution and Utilization of Electrical Energy by C.L.Wadhawa New age International (P) Limited, Publishers 3rd Edition 2011.
3. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2008.

* * *

Open Elective - II

RENEWABLE ENERGY SOURCES

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To impart knowledge on renewable sources of energy and techniques used in exploiting solar, wind, biomass, geothermal and ocean sources of energy.
- To introduce direct energy conversion systems such as thermo electric, MHD and Fuel Cells.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify various types of renewable sources of energy and illustrate the principles of solar radiation.
- illustrate various solar energy storage methods and applications.
- describe the techniques of exploiting wind, biomass and geothermal energies in power generation.
- illustrate the methods of tapping ocean thermal in power generation
- describe the working of various direct energy conversion systems and their applications.

Course Content

UNIT - I:

Introduction: Energy Sources and their availability, role and potential of renewable source.

Solar Radiation: Structure of the sun, the solar constant, sun-earth relationships, extraterrestrial and terrestrial solar radiation, instruments for measuring solar radiation, solar radiation geometry, Numerical problems on solar radiation.

UNIT - II:

Solar Energy Storage and Collectors: Different methods - sensible, latent heat and stratified storage, solar ponds. solar collectors- flat plate, concentric collectors.

Applications of Solar Energy: Solar heating/cooling technique, solar distillation, drying, photovoltaic energy conversion, solar central power tower concept and solar chimney.

UNIT - III:

Wind Energy: Sources and potentials, horizontal and vertical axis wind turbines, Betz criteria.

Bio-Mass Energy: Biomass energy Sources, methods for obtaining energy from biomass, Biomass gasification.

UNIT - IV:

Geothermal Energy: Resources, types of wells, methods of harnessing the energy.

Ocean Energy: Requirements of OTEC, classifications of OTEC, Environmental impacts of OTEC.

UNIT - V:

Direct Energy Conversion: Need for DEC, limitations, principles of DEC. Thermo electric Power – See-beck, Peltier, joule, Thomson effects, Thermo-electric Power generators, applications.

MHD power Generation: Principles, dissociation and ionization, Hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, advantages and disadvantages of MHD power generator, applications.

Fuel cells: Principles, types of fuel cells.

Text Books

1. Tiwari and Ghosal, "Renewable Energy Resources: Basic Principles and Applications", Narosa.
2. B.H.Khan "Non – conventional Energy Resources", Tata McGraw Hill education Pvt. Ltd.
3. G.D. Rai, "Non-Conventional Energy Sources", Dhanpat Rai and Sons.

Reference Books

1. Twidell & Weir, "Renewable Energy Sources ", Routledge (Taylor &Francis Group).
2. SP Sukhatme, "Solar Energy: Principles of thermal collection and storage". Tata McGraw Hill.

* * *

Open Elective - II

VENTURE DEVELOPMENT

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize the learner with the concepts of venture development

Course Outcomes

Upon successful completion of the course, the students will be able to

- explain the significance of entrepreneurship for economic development.
- distinguish among micro, small, and medium enterprises.
- discuss the role of various agencies to raise the capital.
- apply marketing strategies for a given situation.
- analyse contemporary issues in entrepreneurship.

Course Content

UNIT - I: Entrepreneurship and Entrepreneur

Introduction; characteristics of an entrepreneur, types of entrepreneurs, entrepreneurship in India, women entrepreneurship, rural entrepreneurship.

UNIT - II: Small Scale Industries in India

Concept and definition of micro, small, and medium enterprises, scope and trends of small enterprises in India, role of government in promoting ssi in india, problems of entrepreneurs, planning for setting up an industry, agencies for supporting the process, the businesses planning processes.

UNIT - III: Institutional Finance to Entrepreneur

Small Industries Development Bank of India (SIDBI), export-import Bank, Andhra Pradesh State Trading Corporation (APSTC), Integrated Rural Development Programme (IRDP), Export Credit Guarantee Corporation (ECGC).

UNIT - IV: Entrepreneurial Strategies

Management of small industries- small entreprises and marketing strategies- product life cycle-marketing activities, channels of distribution- market research-marketing problems of small scale industries.

UNIT - V: Contemporary Issues in Entrepreneurship

Introduction- ecological entrepreurship, legal issues, international business opportunities- risk management strategies, diversification strategies , and bankruptcy, social and ethical responsibility of entrepreneurs.

Text Books

1. Robert D.Hisrich, Mathew J. Manimala, Michael P.Peters, A.Shepherd, "Entrepreneurship" , McGraw Hill Education, 2016 .
2. P.Narayana Reddy, "Entrepreneurship - Text and Cases", Cengage Learning, 2011.

Reference Books

1. G.G. Meredith, R.E.Nelson and P.A. Neek, "The Practice of Entrepreneurship", ILO, 1982.
2. David H.Holt, "Entrepreneurship New venture Creation", PHI Learning Limited.
3. MadhuriLall, ShikhaSahai, "Entrepreneurship", Excel Books, Second Edition.

* * *

Open Elective - II

AUTOMOTIVE ELECTRONICS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the electronic systems inside an automotive vehicle.
- To introduce the concepts of advanced safety systems.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe the fundamentals of automotive technology.
- differentiatedigital andanalog systems.
- classify various automotive sensors and control systems.
- develop communications & navigation/routing in automotive vehicles.

Course Content

UNIT - I: Automotive Fundamentals

Use of electronics in the automobile, evolution of automotive electronics, theautomobile physical configuration, evolution of electronics in the automobile, surveyof major automotive systems.

UNIT - II: Automotive Micro-Computer System

Microcomputer fundamentals-digital versusanalog computers, basic computer block diagram, microcomputer operations,CPU registers, accumulator registers, condition code register-branching;microprocessor architecture, memory-ROM, RAM; I/O parallel interface, digitalto analog converter and analog to digital converters with block diagram.

UNIT - III: Basics of Electronics Engine Control

Motivation for electronic engine control, exhaust emissions, fuel economy, conceptof an electronic engine control system, engine functions and control, electronicfuel control configuration, electronic ignition with sensors.

UNIT - IV: Sensors and Actuators

Basic sensor arrangement; types of sensors such as oxygen sensors,crank angle position sensors, fuel metering/vehicle speed sensors and detonation sensors, flow sensors, throttle position sensors, solenoids,actuators – fuel metering actuator, fuel injector, and ignitionactuator.

UNIT - V: Electronic Vehicle Management System

Cruise control system, antilock braking system, electronic suspension system,electronic steering control, safety: air bags, collisionavoidance radar warning system with block diagram, low tire pressure warningsystem.

Sensor multiplexing, control signal multiplexing with blockdiagram, automotive internal navigation system, GPS navigation system, Distributed Control Area Network example - a network of embedded systems in automobile.

Text Books

1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition SAMS/ElsevierPublishing.
2. Raj Kamal, "Embedded Systems - Architecture, Programming and Design", 3rd Edition, McGraw-Hill Education.
3. Robert Bosch Gambh, "Automotive Electrics Automotive Electronics Systems and Components", 5th edition, John Wiley& Sons Ltd., 2007.

Reference Books

1. Ronald K Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
2. G. Meyer, J. Valldorf, W. Gessner, "Advanced Microsystems for AutomotiveApplications", Springer, 2009.
3. Robert Bosch, "Automotive Hand Book", 5th Edition, SAE, 2000.

* * *

Open Elective - II

INTRODUCTION TO SIGNAL PROCESSING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the basic concepts and operation on signals.
- To introduce various transform techniques on signals.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify the signals and various operations on signals.
- compute Fourier analysis on the signals.
- applyvarious sampling techniques on continuous time signals.
- analyzecontinuous time signals using Fourier and Laplace transforms.

Course Content

UNIT - I: Signal Analysis

Classification of signals, basic operations on signals-amplitude and time scaling, time shifting, addition and multiplication, introduction to elementary signals-unit step, impulse, ramp, parabolic, rectangular, triangular, sinusoidal, exponential, signum, sinc and gaussian functions.

UNIT - II: Fourier Series

Trigonometric and exponential Fourier series, relationship between trigonometric and exponential Fourier series, convergence of Fourier series, symmetry conditions-even and odd, complex Fourier spectrum.

UNIT - III: Fourier Transform

Representation of an arbitrary function over the entire interval: Fourier transform, ourier transform of some useful functions and periodic function, properties of Fourier transform, Parseval's theorem.

UNIT - IV: Sampling

Sampling theorem for band limited signals- explanation, reconstruction of signal from samples, aliasing, sampling techniques- impulse, natural and flat top sampling.

UNIT - V: Laplace Transform

Laplace transform of signals, properties of Region of Convergence (ROC), unilateral Laplace transform, properties of unilateral Laplace transform, inversion of Laplace transform, relationship between Laplace and Fourier Transforms.

Text Books

1. B.P.Lathi, “Signals, Systems &Communications”, BS Publications, 2003.
2. A.V. Oppenheim, A.S. Willsky and S.H.Nawab, “Signals and Systems”, 2nd EditionPHI.

Reference Books

1. Simon Haykin and Van Veen, “Signals &Systems”, 2nd edition, Wiley Publishers.
2. Michel J. Robert , “Fundamentals of Signals and Systems”, International Edition, Tata McGraw-Hill, 2008
3. C.L.Philips, J.M. Parr and Eve A. Riskin, “Signals, Systems and Transforms”, 3rd Edition, Pearson Education, 2004.

* * *

Open Elective - II

NETWORK PROGRAMMING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the basics of network Technologies.
- To impart in-depth knowledge in socket creation and client-server communication in TCP and UDP.

Course Outcomes

Upon successful completion of the course, the students will be able to

- analyze the requirements of a networked programming environment and identify the issues to be solved.
- interpret the basic network technologies and protocols usage by common internet application.
- develop client-server communication using TCP for communicating processes exist in the different systems.
- apply theoretical principles and use appropriate functions for establishing client-server communication.
- develop client-server communication using UDP protocols by writing socket programming.

Course Content

UNIT - I: Introduction to Network Programming

OSI model, UNIX standards, TCP and UDP and TCP connection establishment and termination, port numbers, TCP port numbers and concurrent servers, buffer sizes and limitation, protocol usage by common internet application.

UNIT - II: Sockets

Address structures, value–result arguments, byte ordering and manipulation functions. Elementary TCP sockets–socket, connect, bind, listen, accept, fork function, concurrent servers.

UNIT - III: TCP Client-Server

Introduction, TCP echo server functions, normal startup, termination, POSIX signal handling, termination of server process, crashing and rebooting of server host, shutdown of server host.

UNIT - IV: I/O Multiplexing and Socket Options

I/O models, select function, poll function, TCP echo server, getsockopt and setsockopt functions.

UNIT - V: Elementary UDP Sockets

Introduction, UDP echo server function, lost datagrams, UDP example, lack of flow control with UDP.

Text Books

1. W.Richard Stevens, Bill Fenner, Andrew M. Rudoff, "UNIX Network Programming: The Sockets Networking API", Volume 1, 3rd edition, Addison-Wesley.
2. W. Richard Stevens, "UNIX Network Programming", 1st edition, PHI.

Reference Books

1. Graham Glass, King Ables, "UNIX for Programmers and Users", 3rd edition, Pearson Education.
2. Marc. J. Rochkind, "Advanced UNIX Programming", 2nd edition, Pearson Education.

* * *

Open Elective - II

SOCIAL NETWORK ANALYSIS

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To provide students with essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate social network analysis and measures.
- analyze random graph models and navigate social networks data
- apply the network topology and Visualization tools.
- analyze the experiment with small world models and clustering models.
- compare the application driven virtual communities from social network Structure.

Course Content

UNIT - I: Graphs

Graphs as models of Networks, Paths and Connectivity, Distance and Breadth-First Search, The Strength of Weak Ties, Structual Holes, Betweenness measure, Homophily, Affiliation, Structural Balance.

UNIT - II: Link Analysis and Web Search

Web as Directed Graph, Searching the Web, Link Analysis Using Hubs and Authorities, Page Rank, Applying Link Analysis in Modern Web Search.

UNIT - III: Cascading Behavior in Networks

Power Laws, Rich-Get-Richer Phenomenon, Diffusion, Cascading Behavior, Cascades and Clusters, Role of Weak Ties.

UNIT - IV: Small World Phenomenon

Six Degrees of Separation, Structure and Randomness, Decentralized search, Empirical Analysis and Generalized Models.

UNIT - V: Basics of Game Theory

Games, Reasoning about behavior in games, Best Responses and Dominant Strategies, Nash Equilibrium, Multiple Equilibria, Mixed Strategies.

Text Books

1. D. Easley and J. Kleinberg, Networks, Crowds and Markets: Reasoning about a highly connected world-2010.
2. Tanmoy Chakraborthy, Social Network Analysis, Wiley.

Reference Books

1. Social Network Analysis: Methods and Applications (Structural Analysis in the Social Sciences) by Stanley Wasserman, Katherine Faust, 1994.

* * *

Open Elective - II

CYBER SECURITY

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To expose the multiple cyber security technologies, processes, and procedures.
- To analyze the threats, vulnerabilities and risks present in these environments.
- To develop appropriate strategies to mitigate potential cyber security problems.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate the fundamentals of cyber crimes and information security systems.
- analyze and resolve security vulnerabilities in networks and computer systems to secure an it infrastructure.
- develop a security architecture for an organization which can handle mobile, wireless devices and related security issues.
- use the cybercrime tools and methods in solving real world problems
- analyze web and internet security threats and find the solutions

Course Content

UNIT - I:

Introduction to Cybercrime: 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.

UNIT - II:

Cyber offenses: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT - III:

Cybercrime-Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Authentication Service Security, Attacks on Mobile/Cell Phones,

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT - IV:

Tools and Methods Used in Cybercrime: Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (IDTheft).

UNIT - V:

Web and Network Security: Introduction, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Overview of Vulnerability Scanning, Scanning for Web vulnerabilities, Firewalls, Packet Filters, How a firewall protects a network.

Text Books

1. Nina Godbole and SunitBelpure ¯ Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives , 1st Edition Publication Wiley, 2011.
2. Mike Shema, ¯Anti-Hacker Tool Kit (Indian Edition) ,1st Edition Publication Mc Graw Hill.

Reference Books

1. Mark Rhodes, Ousley, Information Security, 1st Edition ,MGH, 2013.

* * *

Open Elective - II

E-COMMERCE

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce the basic concepts of E-Commerce.
- To gain the knowledge on various Mercantile Process models.
- To identify the concepts of E-Payment Systems and Web Marketing Strategies.

Course Outcomes

Upon successful completion of the course, the students will be able to

- outline the fundamentals in E-Commerce Frame work and Concepts.
- describe various Mercantile Process models for Consumers and Merchants.
- analyze Electronic Data Interchange (EDI) problems to perform e-transactions.
- categorize and classify various E-Payment systems used in online transaction procesing.
- distinguish various web marketing Strategies to improve customer relationship and marketing.

Course Content

UNIT - I: Electronic Commerce Framework

Introduction, Electronic Commerce Framework, Anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

UNIT - II: Consumer Oriented Electronic Commerce

Consumer Oriented Applications, Mercantile process models, Mercantile models from the consumer's perspective, Mercantile models from the merchant's perspective.

UNIT - III: Inter and Intra Organizational Commerce

Inter Organizational Commerce-EDI, EDI implementation, Value Added Networks, Intra Organizational Commerce -Work flow automation and coordination, Supply chain management.

UNIT - IV: Payment Systems for Electronic Commerce

Online Payment basics, payment cards, Electronic Cash, Electronic Wallets, Stored-Value Cards, Internet Technologies and the Banking Industry.

UNIT - V: Marketing on the Web

Web Marketing Strategies, Communicating with Different Market Segments, Advertising on The Web, E-Mail Marketing, Technology enabled Customer Relationship Management. Search engine Positioning and Domain Names.

Text Books

1. Kalakota, Winston , Frontiers of electronic commerce , Pearson, 2nd Edition, 2012.
2. Gary P.Schneider Thomson , Electronic Commerce, 7th Edition, 2012

Reference Books

1. S.Jaiswal ,E-Commerce, Galgotia publications.
2. Efrain Turbon, Jae Lee, David King ,E-Commerce, H.Michael Chang.

* * *

Open Elective - II

INTELLIGENT SYSTEMS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To understand the fine structure or deeper origin of knowledge
- To generate intelligent behavior on the basis of statistical evidence.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate Data representation and Logical operations.
- analyze backward reasoning and solving problems by reduction.
- learning of Verification and Validation of Rule Bases .
- explain the architecture of real time expert systems.
- define Quantitative simulation.

Course Content

UNIT - I: Knowledge Representation

Data and knowledge: Data representation and data items in traditional databases, Data representation and data items in relational databases. Rules: Logical operations, Syntax and semantics of rules, Data log rule sets, the dependence graph of data log rule sets, objects.

UNIT - II: Rule Based Systems

Solving problems by reasoning: The structure of the knowledge base, the reasoning algorithm, Conflict resolution, Explanation of the reasoning.

Forward reasoning: The method of forward reasoning, a simple case study of forward reasoning, backward reasoning: Solving problems by reduction, the method of backward reasoning, a simple case study of backward reasoning, Bidirectional reasoning.

UNIT - III: Verification and Validation of Rule Bases

Contradiction freeness: The notion of contradiction freeness, Testing contradiction freeness, The search problem of contradiction freeness .Completeness: The notion of completeness, Testing Completeness, The search problem of completeness. Decomposition of knowledge bases: Strict decomposition, Heuristic decomposition.

UNIT - IV: Real-Time Expert Systems

The architecture of real-time expert systems: The real-time subsystem, The intelligent subsystem Synchronization and communication between real-time and in-

telligent subsystems: Synchronization and communication primitives, Priority handling and time-out. Data exchange between the real-time and the intelligent subsystems: Loose data exchange, the blackboard architecture. Software engineering of real- time expert systems: The software lifecycle of real time expert systems, Special steps and tool, An Example of A Real-Time expert System.

UNIT - V: Qualitative Reasoning

Sign and interval calculus, Qualitative simulation: Constraint type qualitative differential equations, The solution of QDEs: the qualitative simulation algorithm: Initial data for the simulation, Steps of the simulation algorithm, Simulation results. Qualitative physics, Signed directed graph (SDG) models.

Text Books

1. Intelligent Control Systems-An Introduction with Examples by Katalin M. Hangos, RozáliaLakner ,MiklósGerzson, Kluwer Academic Publishers.
2. Intelligent Systems and Control: Principles and Applications Paperback – 12 Nov 2009 by Laxmidhar Behera, Indrani Kar by OXFORD.

Reference Books

1. Intelligent Systems and Technologies Methods and Applications by Springer publications.
2. Intelligent Systems - Modeling, Optimization and Control, by Yung C. Shin and Chengying Xu, CRC Press, Taylor & Francis Group, 2009.

* * *

Open Elective - II

RECOMMENDER SYSTEMS

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To learn basic techniques for building recommender Systems.
- To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify the importance of Recommender Systems.
- model Recommender System by using Content-based Filtering technique.
- build Recommender System by Collaborative Filtering technique.
- design Recommender System by Hybrid approaches.
- evaluate Recommender Systems.

Course Content

UNIT - I: Introduction

Introduction, Recommender Systems Function, Data and Knowledge Sources, Recommendation Techniques, Application and Evaluation, Challenges.

UNIT - II: Content-based Filtering

High level architecture of content-based systems, Content representation and content similarity, Similarity-based retrieval, Other text classification methods, Comparative evaluation, Limitations.

UNIT - III: Collaborative Filtering

User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, About ratings, Further model-based and preprocessing-based approaches, Recent practical approaches and systems.

UNIT - IV: Hybrid Approaches

Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade, Meta-level.

UNIT - V: Evaluating Recommender System

Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets.

Text Books

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st edition.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st edition.

Reference Books

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st edition.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st edition.

* * *

Open Elective - II

INTRODUCTION TO IoT ARCHITECTURE

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the basic characteristics and different technologies with the IoT.
- To familiarize with architectures, enabling technologies and design methodologies of IoT.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate the concepts of IoT and its characteristics.
- make use of the design methodologies of IoT.
- compare IoT and M2M.
- outline different technologies used in IoT.
- explain the case studies on IoT.

Course Content

UNIT - I: Internet of Things Concepts

Introduction to Internet of Things, Block diagram of IoT, characteristics of IoT, architectural view of IoT, Physical Design of IoT, Logical Design of IoT.

UNIT - II: IoT Design Templates & Design Methodology

IoT Enabling Technologies, IoT levels, Development Templates, Developing Internet of Things: Introduction, IoT Design Methodology.

UNIT - III: IoT and M2M

M2M, Differences between IoT and M2M, SDN and NFV for IoT, Software defined Networking, Network Function Virtualization.

UNIT - IV: IoT Technologies

Basic building blocks of IoT, Introduction to cloud storage models, Role of Machine learning, Artificial Intelligence and Data Science in IoT, Categories of ML, Applications of ML, Tools in ML, Requirement of Data analytics in IoT.

UNIT - V: Case Studies

Case studies on Domain specific IoT's, Home Automation, cities, environment, Agriculture and health monitoring and energy, Health and fitness monitoring.

Text Books

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On-Approach”, Arshdeep & Vijay Madisetti Publishers, 2014.
2. V.K.Jain, “Data science and Analytics”, Khanna Publishing, 2018.
3. Rajkamal, Internet of Things Architecture & Design Principles”, Mc.Grawhill

Reference Books

1. Vlasios Tsiatsis Stamatis Karnouskos Jan Holler David Boyle Catherine Mulligan, “InternetofThings”, Academic Press, 2018.
2. Daniel Kellmereit, “The Silent Intelligence: The Internet of Things”, Lightning Source Inc., 2014.

* * *

Open Elective - II

INTRODUCTION TO SMART SENSORS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the fundamentals of smart sensors and provides interfacing with embedded hardware.
- To gain knowledge of the latest developments in measurement and sensors expose with the various types of smart sensors.

Course Outcomes

Upon successful completion of the course, the students will be able to

- classify different types of smart sensor for iot applications
- apply signal conditioning circuit for sensor interface to digital computer.
- gain the knowledge required for interfacing the smart sensor
- demonstrate the various packaging types of smart sensor

Course Content

UNIT - I: Sensor Devices

Piezoresistive pressure sensor, Piezoresistive Accelerometer, Capacitive Sensing-Accelerometer and Microphone, Resonant Sensor and Vibratory Gyroscope Nano Sensors.

UNIT - II: Interfacing Sensor Information and MCU

Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion- MCU Control MCUs for Sensor Interface- Techniques and System Considerations- Sensor Integration.

UNIT - III: Control Techniques and Standards

Control of Sensors using - State Machines, Fuzzy Logic, Neural Networks, adaptive Control.

UNIT - IV: Communication for Smart Sensor

Wireless Data Communications- RF Sensing- Telemetry- Automotive Protocols-Industrial Networks, Home Automation- MCU Protocols.

UNIT - V: Packaging, Testing and Reliability Implications of Smart Sensors

Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors-Reliability Implications Testing Smart Sensors- HVAC Sensor Chip.

Text Books

1. Randy Frank, “Understanding Smart Sensors”, Artech House, Second Edition, 2011Boston.
2. Minhang Bao, “Analysis and design principles of MEMS devices”, Elsevier Publications, 2005,USA.

Reference Books

1. Nadim Maluf and Kirt Williams, “An Introduction to Micro Electro Mechanical Systems Engineering”, Second Edition, Artech House Publishers, June 2004, USA.
2. Gabriel M. Rebeiz, “RF MEMS: Theory, Design, and Technology”, Wiley-Inter science; 1st edition, 2002,UK

* * *

Open Elective - III

BASICS OF ENVIRONMENTAL ENGINEERING

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To understand the basic of water borne diseases,drinking water standards and treatment of wastewater and disposal
- To expose the students to understand to treatment of wastewater and disposal
- To learn the basics of air pollution and effects, noise pollution and solid waste disposal

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate water sources, water borne diseases, water treatment and potable water standards
- understand basicsof wastewater treatment and disposal methods
- identity air pollution sources and understand air pollution effects
- identity noise pollution sources and understand noise pollution effects
- understand sources and basic principles of solid waste

Course Content

UNIT - I: Water

Sources of water; Availability of fresh water; Water borne diseases; Brief explanation on ground and surface water treatment; Potable water standards as per IS and WHO standards; Water conservation; Role of public health engineering department in the prevention of the water borne diseases.

UNIT - II: Wastewater

Wastewater sources; Sewage characteristics; Brief explanation on treatment of sewage; Disposal of treated wastewater; Practise on reuse of treated wastewater; Effects of wastewater without treatment disposal in streams, on land

UNIT - III: Air Pollution Sources and Effects

Layers of atmosphere; Sources and classification of air pollutants – Man made, Natural sources; Type of air pollutants; Pollution due to automobiles; Effect of air pollution on health, vegetation and materials; Global warming; Worst environmental disasters caused by humans.

UNIT - IV: Noise Pollution

Sources of noise pollution - plane, point and line sources, multiple sources; Effect of noise pollution on humans; Control of noise pollution; Outdoor and indoor noise propagation; Intensity of noise pollution; Noise pollution permissible limits as per CPCB and WHO

UNIT - V: Solid Waste

Sources of solid waste – classification solid waste - Basic principles of Solid Waste storage, collection, transportation, processing and Disposal.

Text Books

1. Water supply Engineering – Environmental Engineering (Vol. I) by S.K. Garg (2019)– Khanna Publishers.
2. Sewage Disposal and Air Pollution Engineering – Environmental Engineering (Vol. II)S.K. Garg (2019) – Khanna Publishers.
3. Water Supply Engineering by Punmia B.C., Ashok Jain & Arun Jain (2014), Laxmi Publication Pvt., Ltd., New Delhi
4. Wastewater Engineering by Punmia B.C., Ashok Jain & Arun Jain (2014), Laxmi Publication Pvt., Ltd., New Delhi

Reference Books

1. Environmental Engineering by Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, McGraw Hill Inc., New York, 2017.
2. Handbook of Solid Waste Management by Frank Kreith and George Tchobanoglous, McGraw-Hill, 1994.

* * *

Open Elective - III

DISASTER PREPAREDNESS, PLANNING AND MANAGEMENT

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To provide an exposure to disasters, their significance and types.
- To impart the knowledge on different approaches of disaster preparedness.

Course Outcomes

Upon successful completion of the course, the students will be able to

- analyse the concepts, terminologies and developments in thefield of disaster and disaster management.
- differentiate the types of disasters, causes and their impact on environment and society.
- explain the process of risk and vulnerability.
- assess different types of disaster preparedness.
- explain the role of technology in disaster management.

Course Content

UNIT - I: Disaster and Disaster Management

Introduction, Disaster, Hazard – Classification of hazard, Magnitude of disasters, Vulnerability – Categorization of vulnerabilities, Coping Capacity, Risk – Disaster risk management, Risk formula, Disaster Management – Monitoring and evaluation, Disaster management cycle.

UNIT - II: Disasters Classification

Introduction, Types of disasters, Natural disasters - Earthquakes, Cyclones, Flood, Drought, Landslides, Avalanches, Manmade disasters – Chemical disaster, Industrial wastes, Hazardous wastes, Radioactivity, Traffic disasters.

UNIT - III: Risk and Vulnerability

Building codes and land use planning, social vulnerability, Macroeconomic management and sustainable development, environmental vulnerability, climate change risk rendition, financial management of disasterrelated losses.

UNIT - IV: Disaster Preparedness

Introduction, Components of preparedness, Formulation of preparedness plan, Types of disaster preparedness, Principles of preparedness, Problems associated with preparedness.

UNIT - V: Role of Technology in Disaster Management

Disaster management for infra structures, Mitigation program for earthquakes, Geospatial information in agricultural drought assessment, Multimedia technology in disaster risk management training, Transformable indigenous knowledge in disaster reduction.

Text Books

1. Disaster Management – Global Challenges and Local Solutions, by Rajib shah & R R Krishnamurthy, Universities press, 2009.
2. Disaster management,M.M. Sulphey, PHI Learning Pvt. Ltd, 2016.

Reference Books

1. Disaster Science & Management by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazard by S. Vaidyanathan, CBS Publishers& Distributors Pvt. Ltd.
3. Disaster Management - Future Challenges and Opportunities by Jagbir Singh I K International Publishing House Pvt. Ltd, 2007.

* * *

Open Elective - III

PRINCIPLES OF SPECIAL ELECTRIC MACHINES

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize the students with the constructional details, operating principles, theory of torque production, and characteristics of various special electrical machines.
- To expose the students to different control practices associated with various special electrical machines and applications of special electrical machines.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe the constructional and operating principles, control schemes and applications of various types of Stepper Motors.
- explain the constructional details, working principles, control practices and applications of Switched Reluctance Motors.
- analyze the speed-torque characteristics, construction and principle of operation, control techniques and applications of Permanent Magnet Brushless D.C. Motors.
- acquire the knowledge of operating principles, constructional details and applications of Servomotors and Tachometers.
- compare the constructional details, principle of operation and applications of various single phase special electrical machines.

Course Content

UNIT - I: Stepper Motors

Constructional features – Types – Variable Reluctance and Permanent Magnet motors – Principle of operation – Dynamic Characteristics –Closed loop control of Stepper Motor – Applications.

UNIT - II: Switched Reluctance Motors

Constructional features – Principle of operation – Torque Equation – Torque Speed characteristics –Closed loop control of SRM – Applications.

UNIT - III: Permanent Magnet Brushless D.C. Motors

Constructional features – Principle of operation – EMF equations – Torque and Speed characteristics – control of PMBLDC motor –Applications.

UNIT - IV: Servomotors and Tachometers

Servomotor – Types – Constructional features – Principle of Operation – Characteristics – Applications of Servomotors – AC Tachometers – Schematic diagram – Operating Principle.

UNIT - V: Single Phase Special Electrical Machines

AC series Motor – Repulsion Motor – Reluctance Motor - Hysteresis Motor – Constructional features, Principle of Operation, Characteristics and Applications of the above motors.

Text Books

1. Special Electrical Machines by E.G.Janardanan, PHI Learning Pvt Ltd, Delhi, 2014.
2. Principles of Special Electrical Machines by J.Gnanavadivel, Dr.S.Muralidharan and J.Karthikeyan, Anuradha Publications, Chennai, 2013.

Reference Books

1. Stepping Motors and their Microprocessor Controls by Takashi Kenjo, Clarendon Press, 1984.
2. Special Electrical Machines by K.Venkata Ratnam, University press, New Delhi, 2009.
3. Basic Electrical Engineering by C.L.Wadhwa, New Age
4. International (P) Limited Publishers, New Delhi, 2007.
5. Principles of Electrical Machines by V.K.Mehta andRohit
5. Mehta, S.Chand Publishing,New Delhi, 2014.
6. Stepping Motors: A Guide to Modern theory and practice by P.P.Acarnley, Peter Peregrines, London, 2002.
7. Brushless Permanent Magnet & Reluctance Motor Drives by T.J.E. Miller, Clarenden press, Oxford, 1989.

* * *

Open Elective - III

ELECTRICAL INSTRUMENTATION

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize various types of signals, their representation and measurements using CRO.
- To impart knowledge on construction, operation and working principles of digital measuring instruments and Transducers.

Course Outcomes

Upon successful completion of the course, the students will be able to

- analyze various types of signals, and errors in digital instruments.
- measure various parameters like amplitude, phase and frequency of a signal using CRO.
- select a suitable transducer working on electrical principles to measure non electrical quantities.
- select a suitable transducer working on non-electrical principles to measure physical parameters.
- analyse the operation of various digital meters.

Course Content

UNIT - I: Signals and their Representation

Measuring Systems, Performance Characteristics, – Static characteristics – Dynamic Characteristics – Errors in Measurement – Gross Errors – Systematic Errors – Statistical analysis of random errors. Signal and their representation – Standard test, periodic, aperiodic, modulated signal – Sampled data pulse modulation and pulse code modulation.

UNIT - II: Cathode Ray Oscilloscope

Basic operation of Oscilloscope Cathode ray oscilloscope – Cathode ray tube – Time base generator – Horizantal and vertical amplifiers – Measurement of phase and frequency – Lissajous patterns.

UNIT - III: Transducers

Classification of transducers – Characteristics and choice of transducers – Principle operation of resistor, inductor, and capacitor transducers – LVDT – Strain gauge and its principle of operation – Gauge factor– Thermistors – Thermocouples– Piezo electric transducers -– Pyro transducer – Hall sensor.

UNIT - IV: Measurement of Non–Electrical Quantities

Velocity – Angular Velocity – Acceleration – Force – Torque – Measurement of Temperature, Pressure, Vacuum, Flow, Liquid level.

UNIT - V: Digital Voltmeters

Digital voltmeters – Successive approximation, ramp, dual–Slope integration continuous balance type – Micro-processor-based ramp type – DVM digital frequency meter – Digital phase angle meter – Q Meter.

Text Books

1. Electronic Instrumentation–by H.S.Kalsi Tata MCGraw–Hill Higher Education 4thEdition, 2018.
2. Electrical & Electronic Measurement & Instruments,A.K.Sawhney and Puneet Sawhney, Dhanpat Rai & Co., Pvt. Ltd., 18th edition, 2010.

Reference Books

1. Measurement and Instrumentation: Theory and Application, Alan S.Morris and Reza Langari, S. Netherlands: Elsevier Science, 2nd edition,2015.
2. Measurement Systems: Application and Design. Doebelin, E., Japan: McGraw – Hill Higher Education, 4th edition, 2003.
3. Modern Electronic Instrumentation and Measurement Techniques. Cooper,W. D., Helfrick, A. D.India: Pearson Education. 1st edition, 2005.
4. Transducers and Instrumentation. by D. V. S.MURTY, India, PHI Learning 2nd edition, 2010.

* * *

Open Elective - III

GREEN ENGINEERING

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To impart the knowledge needed to minimize impacts of products, processes on environment for sustainable development.

Course Outcomes

Upon successful completion of the course, the students will be able to

- evaluate the impact of technology on environment.
- compare biological ecology to industrial ecology.
- create sustainable products, facilities, processes and infrastructure.
- assess the life cycle of a product to evaluate its impact on energy and materials use.
- analyze technological systems.

Course Content

UNIT - I: Introduction

Humanity and technology, the concept of sustainability, quantifying sustainability.

UNIT - II: Frame Work for Green Engineering

Industrial ecology, relevance of biological ecology to industrial ecology, metabolic analysis, technology and risk, the social dimensions of industrial ecology.

UNIT - III: Implementation

Technological product development, design for environment and sustainability-customer products- buildings and infrastructure.

UNIT - IV: Life Cycle Assessment

An introduction to life cycle assessment, the LCA impact and interpretation stages, streamlining the LCA process.

UNIT - V: Analysis of Technological Systems

Systems analysis, industrial ecosystems, material flow analysis, energy and industrial ecology, air quality impacts, carbon cycles and energy balance, water quality impacts.

Text Books

1. T E Graedel, Braden R Allenby, “Industrial Ecology and Sustainable Engineering”, Prentice Hall, 2010.

2. David T. Allen, David R Shonnard, “Sustainable Engineering Concepts, Design and Case Studies”, Prentice Hall, 2012.

Reference Books

1. Bradley A. Striebig, Adebayo A. Ogundipe, Maria Papadakis, “Engineering Applications in Sustainable Design and Development”, Cengage Learning, 2016.
2. Anastas, Paul T, Zimmerman, Julie B, “Innovations in Green Chemistry and Green Engineering”, Springer, First Edition, 2013.
3. Daniel A. Vallero, Chris Brasier, “Sustainable Design: The Science of Sustainability and Green Engineering”, Wiley, First Edition, 2008.

* * *

Open Elective - III

3D PRINTING TECHNOLOGIES

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To present the various 3D printing technologies for manufacturing.

Course Outcomes

Upon successful completion of the course, the students will be able to

- explain the fundamental principles of Rapid prototyping.
- explain the RP processes and analyze their process parameters.
- select appropriate 3D printing technique for a given application.

Course Content

UNIT - I:

Introduction: Brief description on design process**,** Prototyping fundamentals, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

Rapid Prototyping Data Formats: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file repairs: generic solutions, other translators, newly proposed formats- AMF Files Format.

UNIT - II:

Liquid-Based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies.

Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - III:

Solid-Based Rapid Prototyping Systems: Laminated object manufacturing (LOM) – models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) – models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - IV:

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages

and disadvantages, case studies. three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - V:

RP Applications: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis.

Text Books

1. Ian Gibson, et.al., "Additive Manufacturing Technologies – 3D Printing, Rapid Prototyping and Direct Digital Manufacturing", Springer Publications, 2nd Edition, 2015.
2. Chua C.K., Leong K.F. and LIM C.S, "Rapid prototyping: Principles and Applications", World Scientific publications, 2010.

Reference Books

1. D.T. Pham and S.S. Dimov, "Rapid Manufacturing – The Technologies and Applications of Rapid Prototyping and Rapid Tooling", Springer Publications, 2001.
2. Andreas Gebhardt, Jan – Steffen Hotter, "Additive Manufacturing – 3D Printing for Prototyping and Manufacturing", Hanser Publishers, Munich, 2016.
3. Zimmers&P.Groover, "CAD/CAM", Pearson Education, 1st Edition, 2003.

* * *

Open Elective - III

ASSISTIVE TECHNOLOGIES

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce different assistive technology devices.
- To familiarize with the concepts of enhancing speech communication and Independent Living.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify the adaptation framework connected with assistive technologies.
- demonstrate various types of assessments for assistive technologies.
- explore the processes to enhance speech communication.
- describe the process to enhance mobility and information access.
- analyze the technology aspects needed for independent living.

Course Content

UNIT - I: Introduction to Assistive Technology and Adaptation Framework

Definition and historical overview of assistive technology, multidisciplinary nature of service provision, introduction to adaptations framework, selecting specific characteristics, evaluation of effectiveness of adaptations.

UNIT - II: Assistive Technology Assessments

Overview of assessment issues, overview of general assessments, assistive technology assessments, assessment components.

UNIT - III: Enhance Speech Communication

Nature of spoken language, introduction to augmentative and alternative communication systems, selection techniques for aided communication systems, overview of non-electronic systems and electronic devices.

UNIT - IV: Mobility and Access to Information

Introduction to mobility adaptations, basic design considerations, seating and positioning issues, introduction to information access, computer access, telecommunication, listening and print access.

UNIT - V: Enhance Independent Living

Introduction to independent living, devices for daily life, switches and scanning, environmental control units, access to management devices.

Text Books

1. Diane P edrotty Bryant, Brian R. Bryant, Allyn, Bacon, “Assistive Technology for People with Disabilities”, 2nd Edition, Psycho Educational Services.

Reference Books

1. Marion A. Herash, Michael A. Johnson, “Assistive Technology for the Hearing Impaired, Deaf and Deafblind”, Springer Publications, 2003.
2. Meeko Mitsuko K. Oishi, Ian M. Mitchell, H.F. MachielVanderloss, “Design and use of Assistive Technology”, Springer Publications, 2010.
3. Eckehard Fozzy Moritz, “Assistive Technologies for the Interaction of the Elderly”, Springer Publications, 2014.

* * *

Open Elective - III

INTRODUCTION TO BIO-MEDICAL ENGINEERING

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce the basics of biological concepts and relate it to engineering.
- To familiarize with physiology of cardio-vascular system, respiratory system and the elements of Patient Care Monitoring.
- To impart the knowledge on the diagnostic techniques and shocking hazards.

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate the novel theory related to human body and various components in cardio vascular system.
- relate the concept of electrode theory and transduction principles to bio-medical instrumentation.
- analyze the operation of measuring the cardio-vascular and respiratory systems by knowing its inner organization.
- outline the patient care monitoring.
- apply the fundamental principles & techniques of diagnosis and demonstrate shocking hazards related to biomedical instrumentation.

Course Content

UNIT - I: Introduction to Bio-Medical Instrumentation and Electro-Cardiography

Man instrumentation system-introduction & components, physiological system of the body, sources of bio-electric potentials, resting & action potentials,The heart & cardiovascular system, Electro-Cardiography, Electro-Cardiogram(ECG),Electro-Encephalogram(EEG).

UNIT - II: Electrodes& Transducers

Bio-potential electrodes, basic transducers-transduction principles, biochemical transducers, active & passive transducers, transducers of bio-medical applications.

UNIT - III: Measurements of Cardio-Vascular & Respiratory Systems

Blood pressure measurement, pulse sensors, the physiology of the respiratory system, tests & instrumentation for the mechanics of breathing, respiration sensors, respiratory therapy equipment.

UNIT - IV: Patient Care & Monitoring

Elements of intensive care monitoring, patient monitoring displays, diagnosis,organization of the hospital for patient care monitoring, pace-makers, defibrillators.

UNIT - V: Diagnostic Techniques &Shocking Hazards

Principles of ultrasonic measurement, Ultrasonic Imaging, Ultrasonic Diagnosis, X-Ray &CT Scan, MRI,shock hazards & prevention, physiological effects & electrical equipment, methods of accident prevention

Text Books

1. Onkar N. Pandey, Rakeshkumar, "Bio-Medical Electronics and Instrumentation", S. K. Kataria& Sons, 2007.
2. Cromewell, Wiebell, P.feiffer, "Biomedical instrumentation and measurements",Prentice-Hall, 1973.

Reference Books

1. Joseph J.Carr, John M.Brown, "Introduction to Bio-Medical EquipmentTechnology", 4th Edition, Pearson Publications.
2. Khandapur, "Handbook of Bio-Medical Instrumentation", 2nd Edition, Tata McGrawHill.

* * *

Open Elective - III

DEVOPS

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with precise knowledge of tools to architect effective pipelines by selecting tools suitable for specific scenarios.

Course Outcomes

Upon successful completion of the course, the students will be able to

- explain fundamentals and advance concepts of Agile and DevOps.
- describe Usage of multiple tools for unit functions in a DevOps pipeline.
- illustrate various types of version control systems, continuous integration tools.
- elaborate on various tools to orchestrate, deployment, infrastructure management.
- outline Devops and Cloud work together.

Course Content

UNIT - I: The World without DevOps and Agile Methodology and DevOps

Introduction- Problem Case Definition, Benefits of fixing Application Development Challenges, DevOps Adoption Approach through Assessment.

Agile Methodology and DevOps - Before Agile-Waterfall, Agile Development, What is DevOps, DevOps Importance and Benefits, Devops Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing.

UNIT - II: Tool Suits

Introduction, Atlassian Tools - Key Features, where can Atlassian be Best Utilized, Pros and cons of Atlassian, Phabricator - Key Features, where can Phabricator be Best Utilized, Pros and cons of Phabricator.

UNIT - III: Orchestration

Introduction, Jenkins- Features, Example of Reference Architecture. Ansible - Key Features, Pros and Cons, Example of Reference Architecture, Bamboo- Key Features, Pros and Cons, Example of Reference Architecture.

UNIT - IV: Application Lifecycle Management and Deployment and Infrastructure Management

Introduction, JIRA - Key Features, Pros and Cons, Example of Reference Architecture, Chef - Key Features, Pros and Cons, Example of Reference Architecture.

UNIT - V: DevOps with Cloud

Introduction, DevOps and Cloud Adoption- Benefits of using DevOps along with Cloud, Few best practices for DevOps in the Cloud. AWS- Reasons for selecting AWS for DevOps. Features of AWS, AWS tools and services for Orchestrating DevOps Capability, Pros and Cons.

Text Books

1. Deepak Gaikwad, Viral Thakkar, DevOps Tools, from Practitioner's viewpoint, 1st edition, Wiley.
2. Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, 1st edition, 2010.

Reference Books

1. Jenkins and Kubernetes, Pierluigi Rit, Pro DevOps with Google Cloud Platform With Docker, Apress.

* * *

Open Elective - III

OBJECT ORIENTED ANALYSIS AND DESIGN

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To get familiar with the Object Oriented Analysis and Design in software development, develop UML structural and behavioral models of an application.
- To describe and choose an appropriate Design Pattern to refine the model.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply the object oriented analysis and designs in software development and familiar with the UML concepts.
- develop static conceptual models of the system.
- create dynamic behavioral models of the system to meet user needs.
- design object oriented architecture models.

Course Content

UNIT - I: Introduction to UML

Importance of modeling, principles of modeling, object oriented modeling, Conceptual model of the UML, Architecture of UML.

UNIT - II: Structural Modelling

Structural Modeling:Classes, Relationships: Dependency, Generalization, Realization and Association- advanced features of association, Class diagrams, Interfaces and Packages, Object Diagrams.

UNIT - III: Behavioral Modelling

Behavioral Modeling: Use case, Use case Diagrams, Interactions, Interaction Diagrams- Sequence diagram, Collaboration diagrams.

UNIT - IV: Advanced Behavioral Modelling

Activity diagrams, Common modeling techniques of Activity diagram.

Advanced Behavioral Modeling: Events and signals, state machines, state chart diagrams.

UNIT - V: Architectural Modelling

Architectural Modeling: Components, Component diagrams, Deployment, Deployment diagrams.

Text Books

1. "The Unified Modeling Language User Guide", Booch, James Rumbaugh, Ivar Jacobson, Pearson Education 13th Edition,2004.
2. "Fundamentals of Object Oriented Design in UML", Meilir Page-Jones, Pearson Education.

Reference Books

1. "Object Oriented Analysis and Design with Applications", Grady Booch, Pearson Education Asia, 2nd Edition.
2. "Object-Oriented Systems Ananlysis And Design Using UML", Simon Bennett, Steve McRobb and Ray Farmer , TATA McGrawHill, 2nd Edition.

* * *

Open Elective - III

SCRIPTING LANGUAGES

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with JQuery, JSON, PERL, Ruby, AJAX to develop client-side and server-side web applications.

Course Outcomes

Upon successful completion of the course, the students will be able to

- make use of jQuery with DOM to manipulate HTML elements, attributes and CSS.
- develop script to exchange data between server and browser using JSON.
- develop PERL scripts using arrays, hashes, control structures and subroutines.
- create Ruby scripts using data types, arrays, hashes, control structures and classes.
- develop script to retrieve data from a database using PHP and AJAX.

Course Content

UNIT - I: jQuery

Introduction, Selectors, Events, Effects, Manipulating HTML and CSS using jQuery.

UNIT - II: JSON

Introduction, Syntax rules, JSON vs XML, Data types, Objects, Arrays, Parsing JSON and using stringify() function.

UNIT - III: PERL

Basic Syntax, Perl Language Elements: Variables, Operators, Control Flow Statements, Arrays, Hashes, Subroutines, Packages and Modules, File Handling and Operations on Files, Retrieving Documents from the Web using Perl LWP.

UNIT - IV: Ruby

Introduction to Ruby, Variables, types, simple I/O, Control, Arrays, Hashes, Methods, classes, Iterators.

UNIT - V: AJAX A New Approach

Introduction, Creating XMLHttp Request object, Integrating AJAX with PHP, Retrieving data from a database using PHP and AJAX, Handling XML data using PHP and AJAX.

Text Books

1. Kogent , HTML 5 Black Book, 2nd Edition, Dreamtech Press
2. Dave Thomas, Programming Ruby 1.9 & 2.0: The Pragmatic Programmers' Guide, 4th Edition, Pragmatic Bookshelf.

Reference Books

1. Randal L. Schwartz Brian D. Foy, Tom Phoenix, Learning Perl, 6th edition, O'REILLY Publications.

* * *

Open Elective - III

FUNDAMENTALS OF SOFTWARE PROJECT MANAGEMENT

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To plan and manage projects at each stage of software development life cycle (SDLC).
- To develop effective software projects that support organization's strategic goals.

Course Outcomes

Upon successful completion of the course, the students will be able to

- interpret various necessary rudiments of software project management.
- apply improvement strategies to see the inline growth in economic concerns of the project.
- develop project plans that address real time management challenges.
- design efficient work break down structures that meet real time deadlines of a project.
- use software metrics to measure the quality of software projects and to gain insights of management issues related to the project.

Course Content

UNIT - I: Introduction to Software Project Management

Introduction, project definition, software project vs other types of project, activities covered by software project management, ways to categorize software projects, project as a system, management definition, problems with software projects , management control, stakeholders, requirement specification.

UNIT - II: Conventional Software Management

The waterfall model, conventional software Management performance, Evolution of Software Economics: Software Economics, pragmatic software cost estimation, Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness

UNIT - III: The Old Way and The New

The Old Way and The New: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

UNIT - IV: Checkpoints of the Process

Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT - V: Project Organizations and Responsibilities

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Project Control and Process Instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations.

Text Books

1. Bob Hughes , Software Project Management, 4th edition, Mike Cotterell, TMH.
2. Walker Royce, Software Project Management, Pearson Education, 2005.

Reference Books

1. Joel Henry , Software Project Management, Pearson Education.
2. Pankaj Jalote , Software Project Management in practice, Pearson Education, 2005.

* * *

Open Elective - III

WEB MINING

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To impart machine learning techniques to mine the web and other information networks like social networks and social media.
- To introduce search, retrieval, classification and recommendation methods.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe classic and recent developments in information retrieval, web search and web mining.
- apply Page Rank and HITS algorithm for social network data analysis.
- differentiate Universal, Focused and Topical crawlers in internet.
- analyze complex information and social networks using Information Integration techniques.
- discover sentiment from social media data using opinion mining and web usage mining.

Course Content

UNIT - I: Information Retrieval and Web Search

Basic concepts of information retrieval, IR models, text and web page preprocessing, inverted index and its compression, web search, meta-search.

UNIT - II: Link Analysis

Social network analysis, page rank algorithm, HITS algorithm, community discovery.

UNIT - III: Web Crawling

Crawler algorithm, implementation issues, universal crawlers, focused crawlers, topical crawlers.

UNIT - IV: Information Integration

Schema matching, pre-processing, schema level match, domain and instance level match, 1: m match, integration of web query interfaces.

UNIT - V: Opining and Web Usage Mining

Opining Mining - Sentiment classification, feature based opinion mining, comparative sentence and relation mining, opinion search.

Web Usage Mining - Data collection, data modelling for web usage mining, discovery and analysis.

Text Books

1. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data”, Springer Science & Business Media.
2. Charu C. Aggarwal, “Social Network Data Analytics”, Springer Science & Business Media.

Reference Books

1. GuandongXu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, Springer Science & Business Media.

* * *

Open Elective - III

AI CHATBOTS

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, and study different types of bots and use cases.
- To identify best practices for defining a chatbot use case and use a rapid prototyping framework to develop a use case for a personalized chatbot.

Course Outcomes

Upon successful completion of the course, the students will be able to

- develop an in-depth understanding of conversation design, including onboarding, flows, utterances, entities, and personality.
- design, build, test, and iterate a fully-functional, interactive chatbot using acommercial platform.
- deploy the finished chatbot for public use and interaction.

Course Content

UNIT - I: Introduction

Benefits from Chatbots for a Business,A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape, Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR).

UNIT - II: Chatbot Development Essentials

Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent

UNIT - III: Building a Chatbot Solution

Business Considerations, Chatbots Vs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots.

UNIT - IV: Natural Language Processing, Understanding, and Generation

Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.

UNIT - V: Introduction to Microsoft Bot, RASA, and GoogleDialogflow

Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialogflow.

Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module.

Text Books

1. Abhishek Singh, Karthik Ramasubramanian, ShreyShivam, "Building an Enterprise Chatbot: Work with Protected Enterprise Data Using Open Source Frameworks",ISBN 978-1-4842-5034-1, Apress,2019.

Reference Books

1. Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2017. ISBN 978-1788294669.
2. Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2019. ISBN 978-303004298
3. Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed.), Columbia University Press, 2013. ISBN 978- 0231168564.
4. Abhishek Singh, Karthik Ramasubramanian and ShreyShivam, Building an Enterprise Chatbot (1 ed.), Springer, 2019. ISBN 978-1484250334.

* * *

Open Elective - III

TRENDS IN IoT

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the advanced concepts in IoT
- To familiarize the digital transformation in various fields with the advent of IoT

Course Outcomes

Upon successful completion of the course, the students will be able to

- demonstrate the advantages of edge computing.
- describe the concepts of various technologies in IoT.
- analyze the digital transformation in IoT and future marketing.
- summarize the trust issues in IoT.

Course Content

UNIT - I: Edge Computing

Introduction, Edge Computing Architecture, Background Essentials: IoT Devices, Networking Architecture, Network Management and Control.

UNIT - II: IoT Ecosystems and Technologies

Introduction, support for IoT Ecosystem creation, spurring innovation in lead markets, outlook IoT vision, IoT strategic Research and Innovation Directions, IoT smart environments and applications, IoT and related future technologies.

UNIT - III: IoT and Digital Transformation

IoT Standardization, IoT security, IoT enabling the Digital Transformation of Industry, Case study - Farming Food and IoT: where we are going and challenges.

UNIT - IV: IoT in Future Marketing

Introduction, EU Initiatives and IoT Platforms for Digital Manufacturing, Digital Factory Automation, IoT Applications for Manufacturing.

UNIT - V: Trust in IoT

The need for evaluating trust in IoT, Trust management in IoT, Trust for devices, Trust for IoT services, consent and trust in personal data sharing, using trust in authorization

Text Books

1. Edge computing: Fundamentals, Advances and Applications, K.Anitha Kumari, G.Sudha Sada sivam, D.Dharani, M.Niranjamurthy, CRC Press,Taylor Francis Group,2022
2. Digitising the Industry Internet of Things Connecting the Physical, Digital and Virtual Worlds, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publisher series.

Reference Books

1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”,Apress 2016.
2. Vijay Madisetti, Arshdeep Bahga,” Internet of Things A Hands-On- Approach”, 2014.

* * *

Open Elective - III

ACADEMIC COMMUNICATION

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To acquaint the students with the process and elements of academic writing.
- To help them gain accuracy in the academic writing tasks they will be called upon to perform as part of their graduate and postgraduate studies.
- To empower them to carry out academic writing tasks such as project report writing with success.

Learning Outcomes

Upon successful completion of the course, the student will be able to produce successful academic writing tasks (such as designing and reporting a survey/project, writing discussion essays, and composing formal letters) with attention to:

- the writing process involving a good understanding of the purpose and the register as well as organizational strategies such as introduction, main body, conclusion, paragraphing;
- the elements of academic writing such as argument, cause and effect, cohesion and coherence, generalizations, references, style, and visual information; and
- the kind of accuracy, technical as well as grammatical, that writing in academic contexts demands

Course Content

I. The Writing Process

a. Background to writing

i. The purpose of academic writing
ii. Common types of academic writing
iii. The features of academic writing
iv. Writing in paragraphs

b. From understanding to planning

i. The planning process
ii. Analyzing essay titles
iii. Brainstorming

c. Organizing paragraphs

i. Paragraph structure
ii. Development of ideas
iii. Linking paragraphs together

d. Introductions and conclusions

i. Introduction contents ii. Introduction structure

iii. Opening sentences iv. Conclusions

e. Re-writing and proof-reading

i. Re-writing ii. Proof-reading

II. Elements of Writing

a. Cohesion

i. Reference words ii. Preventing confusion

b. Comparisons

i. Comparison structures ii. Forms of comparison

iii. Using superlatives

c. Style

i. Components of academic style ii. Guidelines

d. Visual information

i. The language of change ii. Types of visuals

iii. Describing visuals iv. Labelling

III. Accuracy in Writing

a. Academic vocabulary b. Remedial grammar

c. Punctuation

IV. Writing Models

a. Formal/Professional emails b. CVs

c. Reports d. Scholarly essays

Suggesting Reading

1. Bailey, Stephen. (2011). *Academic Writing A Handbook for International Students*. Routledge: London.

* * *