B.S.ABDUR RAHMAN
UNIVERSITY
Formerly B.S. Abdur Rahman Crescent Engineering College
(A muslim Minority Institution I Estd. u/s 3 of the UGC Act, 1956)
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REGULATIONS 2013
CURRICULUM AND SYLLABI
(WITH AMENDMENTS INCORPORATED TILL JUNE 2016)

B. TECH
ELECTRONICS AND COMMUNICATION ENGINEERING

UNIVERSITY VISION AND MISSION

VISION

B.S. Abdur Rahman Institute of Science & Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned University
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global Institutions of Excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation

VISION AND MISSION OF THE DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

The Department of Electronics and Communication Engineering envisions to be a leader in providing state of the art education through excellence in teaching, training, and research in contemporary areas of Electronics and Communication Engineering and aspires to meet the global and socio economic challenges of the country.

MISSION

- The Department of Electronics and Communication Engineering endeavors to produce globally competent Engineers prepared to face challenges of the society.
- To enable the students to formulate, design and solve problems in applied science and engineering.
- To provide excellent teaching and research environment using state of the art facilities.
- To provide adequate practical training to meet the requirement of the Electronics & communication industry.
- To train the students to take up leadership roles in their career or to pursue higher education and research.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

B.Tech. (Electronics and Communication Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide a fundamental knowledge in Mathematics and Basic Sciences to enable to solve problems in Electronics and Communication Engineering
- To impart necessary knowledge and skill in the area of Microelectronics, Signal Processing, Telecommunication and Networking.
- To impart practical knowledge and skill sets with the state of the art industrial hardware and software tools to meet the industrial requirement
- To provide knowledge in related disciplines of electronics engineering through elective courses to enable them to work in multidisciplinary areas.
- To train in soft skills to attain leadership roles in industries

PROGRAMME OUTCOMES

Electronics & Communication Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, electronics and communication engineering 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.

PROGRAMME SPECIFIC OUTCOME

13. **Communication Systems:** Analyze and assess various aspects of communication systems and communication mediums for efficient utilization of resources.
14. **Signal Processing:** Apply the concepts of signal processing to real world data for effective analysis and optimization of Information systems.
15. **Electronic Systems:** Design and develop appropriate electronic subsystem to address the application needs of complex engineering problems.

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Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

REGULATIONS 2013
FOR
B.TECH. DEGREE PROGRAMMES
(WITH AMENDMENTS INCORPORATED TILL JULY 2016)

REGULATIONS - 2013 FOR B.TECH. DEGREE PROGRAMMES (With Amendments Incorporated Till July 2016)

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme.

ii) **"Branch"** means specialization or discipline of B.Tech Degree Programme like Civil Engineering, Mechanical Engineering, etc.,

iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.,

iv) **"University"** means B.S. Abdur Rahman University.

v) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of B.S. Abdur Rahman University.

vi) **"Dean (Student Affairs)"** means the Dean (Students Affairs) of B.S. Abdur Rahman University.

vii) **"Controller of Examinations"** means the Controller of Examination of B.S. Abdur Rahman University, who is responsible for conduct of examinations and declaration of results.

2.0 ADMISSION

2.1a) Candidates for admission to the first semester of the eight semester B.Tech. degree programme shall be required to have passed the Higher Secondary Examination of the (10+2) curriculum (Academic stream) prescribed by the appropriate authority or any other examination of any university or authority accepted by the University as equivalent thereto.

2.1b) Candidates for admission to the third semester of the eight semester B.Tech. programme under lateral entry scheme shall be required to have passed the Diploma examination in Engineering / Technology of the Department of Technical Education, Government of Tamil Nadu or any other examination of any other authority accepted by the University as equivalent thereto.

2.2 Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination prescribed by the University for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for plus two academic stream.

2.3 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the University from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. degree programmes in various branches of Engineering and Technology, each distributed over eight semesters with two semesters per academic year.

B.TECH. DEGREE PROGRAMMES:

1. Aeronautical Engineering
2. Automobile Engineering
3. Civil Engineering
4. Computer Science and Engineering
5. Electrical and Electronics Engineering
6. Electronics and Communication Engineering
7. Electronics and Instrumentation Engineering
8. Information Technology
9. Manufacturing Engineering
10. Mechanical Engineering
11. Polymer Engineering
12. Biotechnology
13. Cancer Biotechnology
14. Food Biotechnology

4.0 STRUCTURE OF THE PROGRAMME

4.1 Every programme will have a curriculum with syllabi consisting of theory and practical courses such as,

i) Basic Sciences (BS)
ii) Humanities & Social Sciences (HS)
iii) Management Sciences (MS)
iv) Engineering Sciences Fundamentals (ESF)
v) Engineering Core Courses (EC)
vi) Professional Electives (PE)
vii) General Electives (GE)
viii) Workshop practice, laboratory work, industrial training, seminar presentation, project work, etc.

4.2 Each course is normally assigned certain number of credits:

one credit per lecture period per week

one credit per tutorial period per week

one credit for two to three periods and two credits for four periods of laboratory or practical courses

one credit for two periods of seminar / project work per week one credit for two weeks of industrial training

4.3 Each semester curriculum shall normally have a blend of lecture courses not exceeding seven and practical courses not exceeding four.

4.4 For the award of the degree, a student has to earn a minimum total credits specified in the curriculum of the relevant branch of study. This minimum will be between 175

and 185 credits, depending on the program.

4.5 The medium of instruction, examinations and project report shall be English, except for courses on languages other than English.

5.0 DURATION OF THE PROGRAMME

5.1 A student is ordinarily expected to complete the B.Tech. programme in eight semesters (six semesters in the case of a lateral entry scheme), but in any case not more than 14 continuous semesters reckoned from the date of first admission (12 semesters in the case of lateral entry student).

5.2 Each semester shall consist of a minimum of 90 working days or 450 periods.

5.3 Semester end examination will normally follow immediately after the last working day of the semester.

6.0 CLASS ADVISOR AND FACULTY ADVISOR

6.1 CLASS ADVISOR

A faculty member will be nominated by the HOD as Class Advisor for the whole class (2nd to 8th semester).

He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

However, for the first semester alone the class advisors and faculty advisors will be nominated by first year coordinator.

6.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the students will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment every semester.

7.0 COURSE COMMITTEE

Common course offered to more than one discipline or group, shall have a "Course Committee", comprising all the faculty members teaching the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs), depending on whether all the faculty members teaching the common course belong to the same department / different departments.

8.0 CLASS COMMITTEE

During first semester, a common Class Committee will be constituted for all branches by the Dean (Academic Affairs). During other semesters, separate Class Committees will be constituted by the respective Head of the Department of the students.

8.1 The first semester Class Committee composition will be as follows:

i) The first semester Coordinator shall be the Chairman of the class committee
ii) Course coordinators of all common courses.
iii) Faculty members of all individual courses.
iv) One male and one female first semester student of each class of B.Tech, program to be nominated by the first semester coordinator
v) All first semester class advisors and faculty advisors

8.2 The composition of the class committee for each branch of B.Tech, from 2nd to 8th semester, will be as follows:

i) One senior faculty member preferably not teaching to the concerned class, appointed as Chairman by the Head of the Department
ii) Faculty members of individual courses
iii) Two students, (preferably one male and one female) of the class per group of 30 students or part thereof, to be nominated by the Head of the Department, in consultation with the faculty advisors.
iv) All faculty advisors and the class advisor of the class
v) Head of the Department.

8.3 The class committee shall meet at least thrice during the semester. The first meeting will be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment will be decided for the first, second and third assessments. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

8.4 During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

8.5 The class committee, excluding the student members, shall meet within 10 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide the grades for students in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

9.0 REGISTRATION AND ENROLMENT

9.1 Except for the first semester, every student shall register for the ensuing semester during a specified week before the semester end examination of the current semester. Every student shall submit a completed Registration form indicating the list of courses intended to be enrolled during the ensuing semester. Late registration with the approval of the Dean (Academic Affairs) along with a late fee will be permitted up to the last working day of the current semester.

9.2 From the second year onwards, all students shall pay the prescribed fees for the year on a specific day at the beginning of the semester confirming the registered courses. Late enrolment along with a late fee will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

9.3 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

9.4 A student should have registered for all preceding semesters before registering for a particular semester.

10.1 CHANGE OF COURSE

A student can change an enrolled course within 15 days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

10.2 WITHDRAWL FROM A COURSE

A student can withdraw from an enrolled course at any time before the second assessment for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

11.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

A student can avail a onetime temporary break of study covering the current semester and/or next semester period with the approval of the Head of the Institution at any time before the start of third assessment of current semester, within the maximum period of 14 or 12 semesters as the case may be. If any student is debarred for want of attendance or suspended due to any act of indiscipline it will not be considered as break of study.

A student availed break of study has to rejoin only in the same semester from where he left.

12.0 CREDIT LIMIT FOR ENROLMENT & MOVEMENT TO HIGHER SEMESTER

12.1 A student can enroll for a maximum of 30 credits during a semester including redo courses.

12.2 The minimum credit requirement to move to the higher semester is

- Not less than a total of 20 credits, to move to the 3rd semester
- Not less than a total of 40 credits, (20 for lateral entry) to move to the 5th semester
- Not less than a total of 60 credits, (40 for lateral entry) to move to the 7th semester

13.1 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

Every theory course shall have a total of four assessments during a semester as given below:

Assesment No.	Course Coverage in weeks	Duration	Weightage of Marks
Assessment 1	1 to 4	1.5 Hours	16.6%
Assessment 2	5 to 8	1.5 Hours	16.7%
Assessment 3	9 to 12	1.5 Hours	16.7%`
Semester End Exam	Full Course	3 Hours	50%

76-80% - 1 Mark; 81-85 – 2 Marks; 86-90 – 3 Marks; 91-95 – 4 Marks and 96-100 – 5 Marks

13.2 Appearing for semester end examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

13.3 Every practical course will have 60% weightage for continuous assessment and 40% for semester end examination. However, a student should have secured a minimum of 50% marks in the semester end practical examination.

13.4 In the case of Industrial training, the student shall submit a report, which will be evaluated along with an oral examination by a committee of faculty members,

constituted by the Head of the department. A progress report from the industry will also be taken into account for evaluation.

13.5 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student(s), an oral examination (viva-voce) will be conducted as the semester end examination, for which one external examiner, approved by the Controller of Examinations, will be included. The weightage for periodic review will be 50% and remaining 50% for the project report and Viva Voce examination.

13.6 Assessment of seminars and comprehension will be carried out by a committee of faculty members constituted by the Head of the Department.

13.7 The continuous assessment marks earned for a course during his/her first appearance will be used for grading along with the marks earned in the semester-end examination / arrear examination for that course until he/she completes.

14.0 SUBSTITUTE EXAMINATIONS

14.1 A student who has missed, for genuine reasons, a maximum of one of the four assessments of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident, admission to a hospital due to illness, etc. by a committee constituted by the Dean of School for that purpose.

14.2 A student who misses any assessment in a course shall apply in a prescribed form to the Head of the department / Dean within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

15.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

15.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the University in approved events etc.) to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded “I” grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

15.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the class advisor. The class advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department. Thereupon, the Dean (Academic Affairs) shall announce, course-wise, the names of such students prevented from writing the semester end examination in each course.

15.3 A student should register to re-do a core course wherein “I” or “W” grade is awarded. If the student is awarded, “I” or “W” grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

15.4 A student who is awarded “U” grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course during summer term / regular semester. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the semester-end (redo) examination. If any student obtained “U” grade during summer term course, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

15.5 If a student with "U" grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will be awarded "I" grade in that course.

15.6 The students who have not attended a single hour in all courses in a semester and awarded 'I' grade are not permitted to write the examination and also not permitted move to next higher semester. Such students should repeat all the courses of the semester in the next Academic year.

16.0 SUMMER TERM COURSES

16.1 A student can register for a maximum of three courses during summer term, if such courses are offered by the concerned department during the summer term. Students may also opt to redo such courses during regular semesters.

16.2 The Head of the Department, in consultation with the department consultative committee may arrange for the conduct of a few courses during the summer term, depending on the availability of faculty members during summer and subject to a specified minimum number of students registering for each of such courses.

16.3 However, in the case of students who have completed eighth semester, but having arrears in the earlier semesters in a maximum of two courses, summer courses may be offered, even if less than minimum students may register for the course.

16.4 The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters except that there is no provision either for withdrawal from a summer term course or for substitute examination.

17.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

17.1 All assessments of a course will be made on absolute marks basis. However, the Class Committee without the student members shall meet within 10 days after the semester-end examination and analyze the performance of students in all assessments of a course and award letter grade. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Point
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	--
I	--
AB	--

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevention from semester-end examination

"U" denotes unsuccessful performance in the course. "AB" denotes absence for the semester-end examination.

17.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student.

17.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department and declared by the Controller of Examinations.

17.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester-end theory examination answer scripts of courses, on payment of prescribed fee, through proper application to Dean (Academic Affairs), who shall constitute a revaluation committee consisting of Chairman of the class committee as convener, the faculty member of the course and a senior member of faculty knowledgeable in that course. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

17.5 After results are declared, grade sheets shall be issued to each student, which will contain the following details. The list of courses enrolled during the semester including Summer term (redo) courses, if any, and the grade scored, the Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester, including summer courses if any.

If Ci, is the number of credits assigned for the ith course and GPi is the Grade Point in the ith course

$$GPA = \frac{\sum_{i=1}^{n}(Ci)(GPi)}{\sum_{i=1}^{n} Ci}$$ Where n = number of courses

The Cumulative Grade Point Average CGPA shall be calculated in a similar manner, considering all the courses enrolled from first semester.

"I" and **"W"** grades will be excluded for calculating GPA .

"U", **"I"**, **"AB"** and **"W"** grades will be excluded for calculating CGPA

17.6 After successful completion of the programme, the Degree will be awarded with the

following classifications based on CGPA.

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance an completing the programme within the normal 8 or 6 (for lateral entry) semesters
First Class	6.50 and above and completing the programme within a maximum of 10 or 8 (for lateral entry) semesters.
Second Class	All Ohters

However, to be eligible for First Class with Distinction, a student should not have obtained U and I grade in any course during his/her study and should have completed the U.G. programme within a minimum period covered by the minimum duration plus authorized break of study, if any (clause 11). To be eligible for First Class, a student should have passed the examination in all courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

18.0 ELECTIVE CHOICE: OPTION TO DO PROJECT ALONE IN FINAL SEMESTER

18.1 Apart from the various elective courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department, during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

18.2 In the curriculum of eighth Semester, along with the project work, if two elective courses alone are listed, then the Dean (Academic Affairs) may permit a student, as per approved guidelines, on the recommendation of the Head of the department, to do a full semester major industrial project work. In such a case, the above two elective courses or any other two elective courses in lieu thereof have to be enrolled during any semester preceding or succeeding the project work, if offered.

19.0 PERSONALITY AND CHARACTER DEVELOPMENT

19.1 All students shall enroll, on admission, in any of the personality and character development programmes, NCC / NSS / NSO / YRC / Rotaract and undergo practical training.

- National Cadet Corps (NCC) will have to undergo specified number of parades.
- National Service Scheme (NSS) will have social service activities in and around Chennai.
- National Sports Organization (NSO) will have sports, games, drills and physical exercises.
- Youth Red Cross (YRC) will have social service activities in and

aroundChennai.

- Rotaract will have social service activities in and around Chennai.

20.0 DISCIPLINE

20.1 Every student is required to observe disciplined and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

20.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean will be referred to a Discipline and Welfare Committee, nominated by the Vice-Chancellor, for taking appropriate action.

21.0 ELIGIBILITY FOR THE AWARD OF DEGREE

21.1 A student shall be declared to be eligible for the award of B.Tech. degree provided the student has:

i) successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 14 semester (12 semesters for lateral entry) from the date of admission, including break of study.

ii) no dues to the Institution, Library, Hostels

iii) no disciplinary action pending against him/her.

21.2 The award of the degree must have been approved by the University.

22.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

CURRICULUM AND SYLLABI FOR
B.TECH. ELECTRONICS & COMMUNICATION ENGG.,
(Eight Semesters / Full Time)

CURRICULUM

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	BS	MAB1181	Algebra, Geometry and Calculus	3	1	0	4
2	HS	ENB1181	English*				
		FRB1181	French*				
		ISB1181	Arabic*	3	0	0	3
3	BS	PHB1181	Physics	3	0	0	3
4	BS	CHB1181	Chemistry	3	0	0	3
5	ESF	GEB1101	Engineering Graphics	2	0	3	3
6	HS	SSB1181	Introduction to Economics	3	0	0	3
7	BS	PHB1182	Physics Lab	0	0	2	1
8	BS	CHB1182	Chemistry Lab	0	0	2	1
9	ESF	GEB1102	Basic Engineering Practices Laboratory	0	0	2	1
10	ESF	GEB1103	Computer Programming & Applications	2	0	2	3
							25

* Any one language

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAB1282	Advanced Calculus	3	1	0	4
2.	BS	PHB1283	Physics of Engineering Materials	3	0	0	3
3.	ESF	GEB1211	Basic Engineering Mechanics	3	1	0	4
4.	EC	ECB1211	Network Analysis and Synthesis	3	0	0	3
5.	EC	ECB1212	Electron Devices	3	0	0	3
6.	HS	SSB1182	Sociology, Ethics & Human Values	3	0	0	3
7.	HS	ENB1282	Written Communication	0	0	2	1
8.	EC	ECB1213	Electron Devices Lab	0	0	3	1
9.	BS	PHB1284	Physics of Engineering Materials Lab	0	0	2	1
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SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAB2181	Transforms and Applications	3	1	0	4
2.	HS	SSB2181	Law for Engineers	3	0	0	3
3.	EC	CSB2181	Data structures using C++	3	0	0	3
4.	EC	ECB2101	Electronic Circuits I	3	0	0	3
5.	EC	ECB2102	Signals and Systems	3	1	0	4
6.	EC	ECB2103	Electromagnetic Fields	3	1	0	4
7.	HS	ENB2181	Oral Communication	0	0	2	1
8.	EC	CSB2182	Data structures using C++ Lab	0	0	3	1
9.	EC	ECB2104	Electronic Circuits I Lab	0	0	3	1
							24

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAB2284	Random Process	3	1	0	4
2.	EC	ECB2211	Electronic Circuits II	3	0	0	3
3.	EC	ECB2212	Digital Electronics	3	0	0	3
4.	EC	ECB2213	Analog Communication	3	0	0	3
5.	EC	ECB2214	Linear Integrated Circuits	3	0	0	3
6.	BS	LSB2181	Biology for Engineers	3	0	0	3
7.	HS	ENB2282	Confidence Building & Behavioral Skill	0	0	2	1
8.	EC	ECB2215	Digital Electronics Lab	0	0	3	1
9.	EC	ECB2216	Electronic Circuits II Lab	0	0	3	1
10.	EC	ECB2217	Communication Engineering Lab-I	0	0	3	1
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SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EC	ECB3101	Digital Signal Processing	3	1	0	4
2.	EC	ECB3102	Digital Communication	3	0	0	3
3.	EC	ECB3103	Microprocessors and Microcontrollers	3	0	0	3
4.	EC	ECB3104	Transmission Lines and Antennas	3	1	0	4
5.	HS	MSB3181	Management of Business Organization	3	0	0	3
6.	PE		Professional Elective I	3	0	0	3

7.	HS	ENB3181	Career Building & People Skill	0	0	2	1
8.	EC	ECB3105	Digital Signal Processing Lab	0	0	3	1
9.	EC	ECB3106	Communication Engineering Lab-II	0	0	3	1
10.	EC	ECB3107	Microprocessor & Microcontroller Lab	0	0	3	1
							24

SEMESTER VI

Sl. No.	**Course Group**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1.	BS	GEB3201	Environmental Science and Engineering	3	0	0	3
2.	EC	ECB3211	RF & Microwave Engineering	3	1	0	4
3.	EC	ECB3212	VLSI Design	3	0	0	3
4.	EC	ECB3213	Optical Communication	3	0	0	3
5.	PE		Professional Elective II	3	0	0	3
6.	PE		Professional Elective III	3	0	0	3
7.	EC	ECB3214	VLSI Lab	0	0	3	1
8.	EC	ECB3215	Microwave and Optical Communication Lab	0	0	3	1
							21

SEMESTER VII

Sl. No.	**Course** Group	**Course** Code	**Course Title**	**L**	**T**	**P**	**C**
1.	EC	ECB4101	Cellular Mobile Communication	3	0	0	3
2.	EC	ECB4102	Embedded Systems	3	0	0	3
3.	EC	ECB4103	Computer Networks	3	0	0	3
4.	PE		Professional Elective IV	3	0	0	3
5.	PE		Professional Elective V	3	0	0	3
6.	GE		General Elective I	3	0	0	3
7.	EC	ECB4104	Mini Project - Design & Implementation	0	0	3	1
8.	EC	ECB4105	Networks Lab	0	0	3	1
9.	EC	ECB4106	Embedded Systems Lab	0	0	3	1
							21

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE		Professional Elective VI	3	0	0	3
2.	GE		General Elective II	3	0	0	3
3.	EC	ECB4211	Project	0	0	18	9
							15

Total Credits: 176

PROFESSIONAL ELECTIVES

RF COMMUNICATION

Sl. No.	Course Group	Course Code	Course Title
1.	PE	ECBX01	RF System Design
2.	PE	ECBX02	Electromagnetic Interference & Compatibility
3.	PE	ECBX03	Telecommunication Switching Networks
4.	PE	ECBX04	Wireless Networks
5.	PE	ECBX05	Satellite Communication
6.	PE	ECBX06	Multimedia Communication Systems
7.	PE	ECBX07	Advanced Microwave Systems
8.	PE	ECBX08	Radar & navigational Aids
9.	PE	ECBX18	Image Processing

VLSI & EMBEDDED SYSTEM

Sl. No.	Course Group	Course Code	Course Title
1.	PE	ECBX09	Advanced Microprocessor and Microcontrollers
2.	PE	ECBX10	RTOS
3.	PE	ECBX11	Digital VLSI Testing
4.	PE	ECBX12	Computer Architecture
5.	PE	ECBX13	Advanced Digital System Design
6.	PE	ECBX14	VLSI Signal Processing
7.	PE	ECBX15	ASIC Design
8.	PE	ECBX16	Reconfigurable Computing
9.	PE	ECBX18	Image Processing

SIGNAL PROCESSING

Sl. No.	Course Group	Course Code	Course Title
1.	PE	ECBX17	Advanced Digital Signal Processing
2.	PE	ECBX18	Image Processing
3.	PE	ECBX19	DSP Architecture and Programming
4.	PE	ECBX12	Computer Architecture
5.	PE	ECBX06	Multimedia Communication Systems
6.	PE	ECBX20	Biomedical Signal Processing
7.	PE	ECBX14	VLSI Signal Processing
8.	PE	CSBX52	Soft Computing

GENERAL ELECTIVES
GROUP I COURSES
(To be offered in VII Semester)

Sl. No.	Course Code	Course Title	Offering Department
1	GEBX101	Disaster Management	Civil.
2	GEBX102	Total Quality Management	Mech.
3	GEBX103	Energy Studies	Mech.
4	GEBX104	Robotics	Mech.
5	GEBX105	Transport Management	Auto.
6	GEBX106	Control Systems	EEE
7	GEBX107	VLSI Design	ECE
8	GEBX108	Plant engineering	EIE
9	GEBX109	Network Security	CSE
10	GEBX110	Knowledge Management	CSE
11	GEBX111	Cyber security	IT
12	GEBX112	Genetic Engineering	LS
13	GEBX113	Entrepreneurship Development	CBS
14	GEBX114	Fundamentals of Project Management	CBS
15	GEBX115	Operation Research	Mathematics
16	GEBX116	Nano Technology	Physics/Chemistry

GROUP I COURSES
(To be offered in VIII Semester)

1	GEBX201	Green Design and Sustainability	Civil
2	GEBX202	Appropriate Technology	Civil/Mechanical
3	GEBX203	Engineering System Modeling and Simulation	Mechanical
4	GEBX204	Value Analysis and Engineering	Mechanical
5	GEBX205	Industrial Safety	Mechanical
6	GEBX206	Advanced Optimization Techniques	Mechanical
7	GEBX207	Smart Grid	EEE
8	GEBX208	Embedded System	ECE
9	GEBX209	Usability Engineering	CSE
10	GEBX210	Supply Chain Management	CBS
11	GEBX211	System Analysis and Design	CA
12	GEBX212	Advanced Materials	Physics & Chemistry
13	GEBX213	National Service Scheme	School of Humanities

SEMESTER I

MAB1181	ALGEBRA, GEOMETRY AND CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- developing the skills of engineering students in the basics of chosen topics of Mathematics that are imperative for effective understanding of engineering subjects.
- laying the foundation for learning further topics of Mathematics in higher semesters in a graded manner.
- enabling the learners to appreciate the important role of mathematical concepts in engineering applications.

MODULE I MATRICES 8

Eigenvalue Problems – Eigenvalues and Eigenvectors of a real matrix, Engineering Applications –Properties of Eigenvalues and Eigenvectors – Cayley Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II VECTOR ALGEBRA 6

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl.

MODULE III THREE DIMENSIONAL ANALYTICAL GEOMETRY 8

Direction cosines & ratios – angle between two lines – equations of a plane – equations of a straight line - coplanar lines - shortest distance between skew lines – sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE IV DIFFERENTIAL GEOMETRY 7

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes & evolutes – envelopes – properties of envelopes and evolutes.

MODULE V MULTI-VARIATE FUNCTIONS 8

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobians - Taylor's series expansion – maxima and minima – Lagrange's multiplier method.

MODULE VI ORDINARY DIFFERENTIAL EQUATIONS 8

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined co-efficients, method of variation of parameters.

L:45, T:15

TOTAL HOURS :60

TEXT BOOKS:

1. Veerarajan.T., “Engineering Mathematics” (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., “Higher Engineering Mathematics” (42nd edition), Khanna Publishers, New Delhi, 2012.

REFERENCES

1. Kreyszig, E., “Advanced Engineering Mathematics”, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.
5. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., “Engineering Mathematics”, Volume I, 2nd edition, National Publishing Co., Chennai, 2003.

OUTCOMES:

On completion of the course the students will be able to

- solve Eigenvalue and Eigenvector problems.
- solve three dimensional geometry problems.
- use differential calculus for solving problems pertaining to engineering applications.

ENB1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To expose students to the concept of flipped learning.
- To discuss a range of vocabulary and enable students to use it in academic and technical contexts.
- To facilitate students' effective use of speaking skill while exchanging ideas and making presentations.
- To help students develop listening skill for identifying accent and intonation and comprehending and analyzing the information.
- To develop reading comprehension skill and help them to infer explicit and implicit meanings.
- To hone their creative and academic writing skills.
- To expose them to the correct usage of language and help them to apply it appropriately.

MODULE I **8**

L: Listening for specific information – Note-taking

S: Self introduction – Introducing one another

R: Skimming Technical passages

W: Process of writing – Writing short paragraphs

Language focus: Use of prefixes and suffixes ,Simple tense forms

MODULE II **8**

L: Guessing the meaning through Intonation

S: Exchanging opinions & Agreeing and disagreeing

R: Scanning – reading newspaper articles for specific information W: Argumentative writing – Letter to the editor

Language focus: Modals, Continuous and perfect tenses, Framing questions & Question tags

MODULE III **7**

L- Listening to a specific topic & predicting the content

S – Getting into conversation- Gathering information

R - Reading between lines

W - Letter inviting a dignitary-Expository Writing

Language Focus: Homonyms & Collocation

MODULE IV **7**

L: Listening to telephonic conversation, listening for specific information (Intensive)

S: Short presentations

R: Referential and Inferential reading

W:– Letter seeking permission for industrial visit Language focus: Subject, Verb agreement & Euphemism

MODULE V **8**

L: Listening to scientific podcasts – Cloze exercises

S: Personal narrations

R: Intensive reading – Interpreting graphical data.

W: Describing a process, Flow chart, Bar chart

Language focus: Passive forms, Connectives & Prepositions

MODULE VI **7**

L: Appreciation and critical review of popular movie--The Incredibles S: Discussion in groups - Three Idiots

R: Extensive reading – APJ Abdul Kalam's Wings of Fire - Reading for critical appreciation

W: Writing slogans – Rewriting a story with a different ending

Language focus: If clause, Phrasal verbs & Idiomatic expressions

TOTAL HOURS :45

REFERENCES

1. Carol Rosenblum Perry (2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, NewDelhi.
2. Dutt, P.K Rajeevan.G and Prakash,C.L.N (2007). A Course in Communication Skills. Cambridge University Press, India.
3. Kalam, Abdul &Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and Abridged by Mukul Chowdhri). Hyderabad University Press.
4. Sen, Leena (2004). Communication Skills. Prentice Hall, New Delhi.
5. Matt Firth, Chris Sowton et al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Explore new information from various sources and perform communicative tasks.
- Demonstrate their range of vocabulary in academic and technical contexts.
- Exchange ideas and make presentations.
- Identify, comprehend and respond to different intonation patterns.
- Infer meaning from reading texts.
- Create and construct different kinds of academic documents.
- Communicate effectively using grammatically correct expressions.

FRB1181	FRENCH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve their proficiency in French language.
- To empower them for successful communication in their professional contexts.

DOSSIER 0 FENÊTRE SUR… 7

Contenus –l'alphabet - se présenter – les langues – les nationalités – les nombres de 0 à 60 – les adjectifs de nationalités – les verbes : s'appeler, être.

L'acte de parole

DOSSIER 1 LES UNS, LES AUTRES…. 12

Contenus - Les salutations (formelles et informelles) - les jours de la semaine – Les articles définis – les adjectifs possessifs – la négation (ne…..pas) – les verbes : avoir.

Demander quelque chose – les mois de l'année – les nombres de 70 à 99 – les articles indéfinis – l'adjectif interrogatif (quel, quelle)

Quelques événements culturels – donner des informations personnelles – indiquer ses gouts – l'expression des gouts – les prépositions (les noms de pays).

L'acte de parole

DOSSIER 2 ICI /AILLEURS 12

Contenus – Parler de sa ville – Donner/ Demander des explications – les prépositions de lieu – articles contractés – pourquoi / parce que

Auberges de jeunesse et hôtels – s'informer sur un hébérgement- quelques verbes et indications de direction – quelques formules de politesse.

Le code postal et les départements le libellé d'une adresse en France – Ecrire une carte postale – Dire le temps qu'il fait – les adjectifs démonstratifs - Formules pour commencer / terminer.

L'acte de parole

DOSSIER 3 SOLO OU DUO 14

Contenus – Les animaux de compagnie les animaux préférés des Français - parler de sa profession – les professions - les activités sportifs - les noms animaux – les verbes : aimer , adorer, détester, faire, aller.

Nouveaux mode de rencontres – caractériser une personne (physique et psychologique)– les adjectifs qualificatifs – les pronoms toniques.

Les sorties – proposer, refuser, accepter une sortie – fixer un rendez-vous – inviter – Donner des instructions – L'impératif : 2e personne – Le pronom on=nous – Les verbes : Pouvoir, vouloir, devoir.

L'acte de parole

L'examen oral

TOTAL HOURS :45

Text Book:

1. Alter EGO I – Goyal – Langers (0 – 5 Lessons)

OUTCOMES:

On completion of the course,

- The students will be able to deal with their clients effectively at global level.
- Their proficiency in French Language will have improved.

ISB1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.

Listening and Reading.

Audio & Video aided listening, Tajweed listening, Writing Arabic Alphabets (connected & unconnected).

Introducing words.Reading simple sentences.

Learning names of the things in and around the class room. Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs

Communicating Simple sentences.

Jumla' Ismiyya and Jumla' Fi'liyya

Situational Conversation:

Greetings, Introduction.

Classroom, College, Picnic.

Dining and Kitchen.

Reading skills.

Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.

Audio aids.

Writing Simple sentences.

Communicating ordinal and cardinal numbers.

Situational communication:

Playground, library.

Forms of plural – Sample sentences.

Introduction to tenses.

Exercises.

MODULE IV FUNCTIONAL ARABIC **8**

Communication:

Family, travel

Market, Prayer hall

Writing skills:

Note making.

Sequencing of sentences.

Developing answers from the questions.

Exercises.

MODULE V TECHNICAL ARABIC **8**

Importance of technical communication.

Reading and writing skills.

Audio & Video aided listening.

Introduction to Arabic terms related to administration.

Situation communication:

Air travel, Office administration, passport, visa.

Exercises.

MODULE VI TECHNICAL ARABIC **7**

Situation communication:

Contractual work, machineries and equipments..

Computer, internet browsing.

Banking,

Exercises.

TOTAL HOURS:45

Text Book:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

PHB1181	PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic physics concepts relevant to Engineering and Technology students.
- To get familiarize with solving problems in basic physics.
- To acquaint applications of physics for Engineering issues.

MODULE I PROPERTIES OF MATTER 7

Elasticity – Stress strain diagram – Factors affecting elasticity – Twisting couple on a wire – Shaft – Torsion pendulum – Depression on a cantilever – Young's modulus by cantilever – Uniform and non-uniform bending – Viscosity.

MODULE II CRYSTAL PHYSICS 6

Introduction – Space lattice – unit cell – Bravais lattices – Miller Indices for cubic crystals – Inter planar spacing in cubic lattice – Simple crystal structures – SC, BCC, FCC and HCP structures – Atomic radius, coordination number, Packing factor calculation – Crystal imperfections.

MODULE III QUANTUM PHYSICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jeans law from Planck's theory – Compton effect – Theory and experimental verification – Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schroedinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box.

MODULE IV WAVE OPTICS 9

Interference theory – Air wedge – Michelson interferometer – Diffraction – Fresnel and Fraunhofer diffraction - Polarization – Double refraction – Theory of plane polarized, circularly polarized and elliptically polarized light – Quarter wave plate, Half wave plate – Production and detection of plane, circularly and elliptically polarized lights – Photoelasticity – Photo elastic effect – Stress optic law – Effect of stressed model in a plane polariscope (qualitative) – Photo elastic bench.

MODULE V LASER & FIBRE OPTICS 9

Principle of spontaneous emission and stimulated emission - Characteristics of laser light - Einstein's A & B coefficients (derivation) – Population inversion - pumping - Nd:YAG laser – CO_2 laser – Applications – Material processing and holography (construction and reconstruction of hologram)- Optical fibre – Principle and propagation of light in optical fibers – Numerical aperture and acceptance angle – Types of optical fibers - applications – Fibre optic communication system (block diagram only)- Fibre optic sensors (displacement and pressure sensors (qualitative), Medical endoscope.

MODULE VI ULTROSONICS AND NDT 7

Ultrasonics – Production – Magnetostriction and piezo electric methods – Properties of ultrasonic waves – Detection of ultrasonic waves – Applications –Ultrasonic interferometer-Acoustical grating – SONAR – Depth of sea – Measurement of velocity of blood flow – Non Destructive Testing (NDT) methods – Ultrasonic flaw detector – A,B & C scanning methods.

TOTAL HOURS : 45

Text Book:

1. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3.

REFERENCES

1. Uma Mukherji, “Engineering Physics”, Narosa Publishing House, New Delhi, 2007.
2. Charles Kittel, “Introduction to solid state physics”, 7th Edition, John Wiley & sons (ASIA) Pvt. Ltd, 2008.
3. Avadhanulu M.N., “Engineering Physics”, 1st Edition, S.Chand & Company Ltd., New Delhi, 2007.
4. Schiff, “Quantum Mechanics”, 3rd Edition, Tata McGraw-Hill Education, 2010.
5. Rajendran V. and Marikani A., “Applied Physics for Engineers”, 3rd Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2003
6. William T. Silfvast, “Laser Fundamentals”, 2nd edition, Cambridge University Press, 2004.
7. Arumugam M., “Engineering Physics”, 5th Edition, Anuradha Agencies, 2003.

OUTCOMES:

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

- Apply the knowledge of properties of matter in Engineering Mechanics and Fluid Dynamics.
- Characterize Engineering materials
- Use Lasers for Fiber Optics Technology and Material Processing
- Do non-destrictive testing using Ultrasonic Techniques

CHB1181	CHEMISTRY	L	T	P	C
	(Common to All Branches)	3	0	0	3

OBJECTIVES:

To make students conversant with the

- Water specification for potable and industrial purposes and various treatment methods.
- Different engineering materials, their physico-chemical properties and specific applications.
- Concept of electrochemistry, corrosion and theories of corrosion.
- Principles of spectroscopy and applications.
- Basic principles of green chemistry and the need for green processes in industries.

MODULE I WATER TECHNOLOGY 8

Introduction – Impurities present in water – Hardness, Types of Hardness, Estimation of Hardness (EDTA method) (Problems) – Alkalinity, Estimation of Alkalinity – Disadvantages of hard water in industries – Conditioning methods: external treatment method: Ion exchange method – internal treatment: colloidal, phosphate, calgon, carbonate methods – drinking water standards (BIS) – treatment of domestic water: screening, sedimentation, coagulation, filtration, disinfection: by chlorination, UV treatment, ozonization – desalination and reverse osmosis (principle only).

MODULE II ENGINEERING MATERIALS 8

Abrasives: Moh's scale of hardness – natural abrasives: diamond, corundum, emery, garnets and quartz – artificial abrasives: silicon carbide, boron carbide.

Refractories: characteristics, classification – acid, basic and neutral refractories, properties – refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling – general method of manufacture of refractories, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Nanomaterials: Definition – types of Nanomaterials; nanofilms, nanowires, carbon nanotubes, quantum dots and fullerenes (C60) – Size and shape dependent optical, electrical, thermal and mechanical properties; Synthesis of nanomaterials – Top down and bottom up approach; Applications of nanomaterials – Catalysis, Electronics and Telecommunication, Medicines, Composites and Energy.

MODULE III ELECTROCHEMISTRY AND CORROSION 9

Construction of a cell – Standard and single electrode potential – electrochemical series – EMF and its measurement – Nernst equation, application and problems – Types of electrodes: standard hydrogen electrode, calomel electrode, ion selective electrode - glass electrode and determination of pH using glass electrode – polarization, overvoltage, decomposition potential (statements only) – Conductometric and potentiometric titrations.

Corrosion: Definition – Dry corrosion and Wet corrosion with mechanisms – Factors influencing corrosion.

MODULE IV CHEMISTRY OF POLYMERS 6

Monomers – functionality – polymer – degree of polymerization – classification– Polymerization techniques: addition, condensation and co-polymerization with example – mechanism of polymerization: free radical, cationic and anionic mechanism – thermoplastics and thermosetting plastics with examples – compounding and moulding of plastics: injection moulding and compression moulding.

MODULE V SPECTROSCOPY 9

Electromagnetic spectrum – absorption of radiation – electronic, vibrational, translational and rotational – intensities of spectral lines – Beer-Lambert's Law (Problems) – Colorimetric analysis: estimation of concentration of a solution – Flame photometry: theory, instrumentation (block diagram only) and application – UV-Visible spectroscopy: Principle, instrumentation (block diagram only) and simple applications – IR spectroscopy – simple applications only.

MODULE VI GREEN CHEMISTRY 9

Introduction – Significance – Industrial applications of green chemistry; Green technology – Latest green laboratory technique for saving experimental resources and infrastructural framework; Principles of green chemistry – R4M4model (Reduce, Reuse, Recycle, Redesign; Multipurpose, Multidimensional, Multitasking, Multi-tracking) – Life cycle analysis technique (cradle to grave approach)

TOTAL HOURS : 45

Text Book:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. Paul T. Anastas, John C. Warner, Green Chemistry: Theory and Practice, Oxford University Press, 1998.

REFERENCES

1. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.
2. Kuriacose J.C. and Rajaram J, Chemistry in Engineering and Technology, Volume1, Tata McGraw- Hill publishing company, New Delhi, 1996.
3. Puri B.R., Sharma L.R. and Madan S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., Jalandhar, 2000.

OUTCOMES:

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

- estimate the degree of hardness and alkalinity in water and describe treatment methods for potable water.
- summarise the properties and uses of various engineering materials and choose the appropriate material for a given application.

- illustrate the different types of electrodes, calculate the emf and apply the electrochemistry principles to explain the mechanism of corrosion.
- describe the mechanism of polymerization and moulding techniques.
- explain the principles and instrumentation of various analytical techniques and adopt the suitable techniques for analysis of compounds / elements.
- outline the principles and significance of green chemistry.

GEB1101	ENGINEERING GRAPHICS	L	T	P	C
	(Common to All Branches)	2	0	3	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide an exposure to the appropriate standards for technical drawings
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, pictorial views and free hand drawing
- To introduce computerized drafting

MODULE I BASICS AND ENGINEERING CURVES 10

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions. Conic sections: ellipse, parabola, hyperbola Special curves: Cycloid, epicycloid, hypocycloid, involutes, helix

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, third angle projection methods, free hand sketching of orthographic views of simple machine parts as per first angle projection. Projection of points. Commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Straight lines in first quadrant – true length and true inclinations, traces – rotating line and trapezoidal methods. Projection of plane lamina in first quadrant – trace of plane.

MODULE IV PROJECTION OF SOLIDS 10

Projection of solids: Axis inclined to one reference plane only - prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 10

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional views – true shape of sections - solids in simple position and cutting plane inclined to one reference plane only. Development of surfaces: truncated solids - prism, pyramid, cone, cylinder, frustum of cone and pyramid.

MODULE VI PICTORIAL PROJECTIONS 12

Isometric projection: isometric scale - isometric projection and view of prism, pyramid, cylinder, cone, frustums and truncated solids.

Perspective projection: prism, pyramid, cylinder, frustums – visual ray and vanishing point methods.

TOTAL HOURS: 60

Text Book:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 46th Edition, (2003)

REFERENCES

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai.(2006)

2. Venugopal. K, and V. Prabhu Raja, 'Engineering Graphics', New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

Students who complete this course will be able to:

- draw various views of engineering components
- graphically communicate their concepts and ideas on new designs

SSB1181	INTRODUCTION TO ECONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and exchange.
- To create an awareness about the industrial sector, markets and trade and their contribution to economic development.
- To describe the five year plans, budget, fiscal policy and taxation.
- To discuss Indian economy and justify the role of engineers in economic development.

MODULE I INTRODUCTION 8

Classification of economy – open and closed economy – Sectors of economy – Basic principles of Microeconomics – supply, demand and equilibrium, Elasticity of demand – Pricing models.

MODULE II NATIONAL INCOME DETERMINATION 7

National income concepts – GNP, GDP, disposable income; Aggregate demand and aggregate supply, Macroeconomic equilibrium - Concepts of MPS, APS, MPC APC, Inflation – Price indices - WPI, CPI and Inflation control.

MODULE III MONEY AND BANKING 7

Role and functions of money - Monetary System - Money market - Role of Central Bank - Monetary policy - Commercial banks - Development banks - Capital market and Debt market.

MODULE IV INDUSTRY, LABOUR MARKET AND TRADE 7

Public and Private sectors, Contribution to the National economy - Industrial policy - Labour market - Trade: Domestic and International trade.

MODULE V BUDGET, POLICIES AND INDICATORS 8

Economic development – Five year plans, Macroeconomic indicators - Central budget - Government tax- revenue and non-tax revenue, Government expenditures - plan and non-plan expenditures – Fiscal policy – The impact of the budget on the economy.

MODULE VI ECONOMIC GROWTH AND THE ROLE OF ENGINEERS 8

Indian Economy – Development in the post independence era – Growth of the economy, Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Contribution of engineers to the economic growth.

TOTAL HOURS: 45

Text Book:

1. Vanitha Agarwal, Macroeconomics: Theory and Practice, Pearson, 2010.
2. Dwivedi D.N, Macroeconomics: Theory and Policies, 3rd edn; McGraw Hill, 2010.
3. Samuelson, Paul A., Macroeconomics, 19thedn., TMH, 2009.
4. Gupta G.S, Macroeconomics: Theory and Applications, 3rd edn; TMH, 2007.
5. R.K. Lekhi, Public Finance, Kalyani Publishers.
6. D. M. Mithani, Money, Banking, International Trade and Public Finance, Himalaya Publishing House.
7. R.R. Paul, Monetary Economics, Kalyani Publishers.
8. Benson Kunjukunju and S. Mohanan, Financial System and Financial Institutions in India, New Century Publications.
9. Raddar Datt, K.P.M. Sundharam, Indian Economy, S. Chand.
10. Gregory Mankiw, Principles of Economics, Cengage Learning.
11. Gregory Mankiw, Principles of Microeconomics, Cengage Learning.
12. Uma Kapila, Indian Economy since Independence, Academic Foundation.
13. Andrew Gillespie, Business Economics, Oxford University Press.
14. Pindyck, Rubinfeld and Mehta, Microeconomics, Pearson.
15. C.B. Gupta, Business Environment, Sultan Chand and Sons.

OUTCOMES:

On successful completion of this course,

- Students will have an exposure to the basic concepts of microeconomics and macroeconomics.
- Students will be able to identify the concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and exchange in their real life situations.
- Students will have gained knowledge in government budget, economic planning and its implementation.
- Students will have an overview of the economic reforms introduced in Indian economy.
- Students will be able to analyze the importance of economics and apply the knowledge they have gained in their professional pursuits.

PHB1182	PHYSICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the basic concepts of properties of matter, wave optics
- To understand the properties of ultrasonic and Laser.
- To understand the crystal growth technique.
- To correlate the experimental results with the theoretical values.

LIST OF EXPERIMENTS

1. Torsional Pendulum- Determination of rigidity modulus of a given wire.
2. Determination of coefficient of viscosity of a liquid by Poiseuille's method .
3. Determination of Young's modulus of a beam using non – uniform bending method.
4. Determination of a thickness of a given wire – Air wedge.
5. Spectrometer- determination of wavelength of given source by using grating.
6. Determination of velocity of ultra sonic waves – Ultrasonic Interferometer.
7. Determination of numerical aperture and acceptance angle of an optical fiber.
8. Determination of particle size using Laser.
9. Growth of crystal by slow evaporation technique.
10. Determination of angle of divergence of Laser beam.
11. Photo electric effect experiment.

OUTCOMES:

On completion of this course, the student will know

- Properties of matter, wave optics and quantum physics
- Properties and application of Ultrasonic and Laser
- Principle and concept of crystal growth technique.

CHB1182	CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

To make students conversant with the

- estimation of hardness and TDS in water samples.
- construction of cell and determination of EMF.
- estimation of pH of solutions.
- verification of Beer Lambert's law.

LIST OF EXPERIMENTS

1. Estimation of hardness in domestic water.
2. Estimation of total dissolved solids (TDS) in domestic water
3. Construction and determination of emf of a cell.
4. Determination of single electrode potential.
5. Estimation of strong acid in the industrial effluents
6. Estimation of Fe2+ present in unknown sample by Potentiometry
7. Verification of Beer-Lamberts law and estimation of Cu2+ present in unknown sample.
8. Estimation of Na and K present in the agricultural field.
9. Study of effect of inhibitors in free radical polymerization (Demo)

OUTCOMES:

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

- estimate the degree of hardness and TDS in water samples.
- construct and calculate EMF of cell.
- apply the concept of Beer lamberts law.

GEB1102	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
	(Common to All Branches)	0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mould preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC,MCCB,ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp.

ELECTRONIC ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Solderingand tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project

OUTCOMES:

Students who complete this course

- Should be able to appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Should be able to attend minor defects especially in items used in day to day life
- Should be aware of the safety aspects involved in using tools and instruments

GEB1103	COMPUTER PROGRAMMING & APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Expose fundamental concepts and techniques in computer programming
- Give coverage on application logic in programming
- Focus on solving practical problems based on analyzing, designing, and implementing computer programs

MODULE I FUNDAMENTALS OF COMPUTERS 5

Evolution – Generations - Classifications – Applications – Computer organization – Hardware in a typical computer Identification - Booting – Booting error messages - Number system - Number system conversions

MODULE II BASIC PROGRAMMING AND DEBUGGING 5

Software types – Types of Operating systems - Software development steps – Information technology and internet - The programming tool - Structure of a basic program - Hello world program – Debugging it – Character set – Delimiters – Keywords, identifiers – Constants – Variables –- Tools and help features – Comments in a program

MODULE III INPUT AND OUTPUT 5

Data types - Type conversions - Input/Output: Formatted functions – Unformatted functions – Library functions – Debugging the code – Systems software: Compiler – interpreter- linker – loader - Finding the correct answer given a code snippet and justifying it

MODULE IV PROBLEM SOLVING 5

Problem solving techniques: Algorithm, flowchart – Pseudo-code – Examples of simple problems in algorithms and flowcharts – Sorting and Searching - Characteristics of a good program – Generations of programming language

MODULE V OPERATORS AND DECISION STATEMENTS 5

Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators – If –if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement

MODULE VI ARRAYS AND LOOP CONTROL STATEMENTS 5

Arrays – Initialization – Definition – Characteristics – One dimensional array – Two dimensional arrays - Multi dimensional arrays – Predefined streams - Operation with arrays – Sorting and searching – Structures – Operations on structures

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting - error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types Type conversions
5. Input/Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching

TOTAL HOURS: 60

Text Book:

1. Ashok N Kamthane, “Computer Programming”, 2nd Edition, Pearson Education, 2012.
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, 7th Edition, Pearson, Education, 2012.

OUTCOMES:

Students who complete this course will be able to

- Apply Modular design, logic flow and data abstraction in programming paradigm.
- Use the concepts of constructs, functions, I/O and algorithms in the programming environment.
- Develop simple real time applications using the programming constructs and algorithms

SEMESTER II

MAB1282	**ADVANCED CALCULUS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aim of the course is to

- train the students in additional areas of Engineering Mathematics, necessary for grooming them into successful engineers. The topics will serve as basic tools for specialized studies in many engineering fields, significantly in fluid mechanics, field theory and communication engineering.

MODULE I DOUBLE INTEGRALS 7

Double integration – Cartesian and Polar coordinates – change of order of integration – area as a double integral –– change of variables between Cartesian and polar coordinates.

MODULE II TRIPLE INTEGRALS AND SPECIAL FUNCTIONS 7

Triple integration in Cartesian coordinates - change of variables between cartesian, cylindrical and spherical polar coordinates - Beta and Gamma functions.

MODULE III VECTOR INTEGRATION 7

Line, surface and volume integrals – Green's, Gauss Divergence and Stoke's theorems (without proof) – verification and evaluation of integrals using them.

MODULE IV ANALYTIC FUNCTION 8

Analytic function - Necessary and Sufficient condition (Proof not included) – Cauchy-Riemann equations in polar coordinates - properties of analytic function– determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE V COMPLEX INTEGRATION 8

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

MODULE VI PARTIAL DIFFERENTIAL EQUATIONS 8

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

L:45, T:15

TOTAL HOURS:60

Text Book:

1. Veerarajan.T., “Engineering Mathematics “(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.

2. Grewal B.S., “Higher Engineering Mathematics” (42nd edition), Khanna Publishers, New Delhi, 2012.

REFERENCES

1. Kreyszig, E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.

2. Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th edition, Cengage Learning, 2011.

3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.

4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

5. Ramana, B.V., “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

6. Venkataraman, M.K., “Engineering Mathematics”, Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.

OUTCOMES:

On completion of the course the students will be able to

- solve integrals of higher orders.
- apply vector calculus for solving engineering problems.
- solve complex differentiation and integration problems related to engineering.
- formulate practical problems in terms of partial differential equations, solve them and physically interpret the results.

PHB1283	PHYSICS OF ENGINEERING MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize the physical, chemical, electrical and mechanical properties of different Engineering materials.

MODULE I CONDUCTING MATERIALS 10

Electron ballistics : charged particle, force on charged particles in an electric field, force on charged particles in Magnetic field - Parallel electric and magnetic field - Perpendicular electric and magnetic field - Classical free electron theory of metals – Derivation for electrical conductivity – Merits and drawbacks of classical theory – Quantum free electron theory of metals and its importance (qualitative) – Energy distribution of electrons in metals – Fermi distribution function – Density of energy states and carrier concentration in metals (derivation) – Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of band theory.

MODULE II SEMICONDUCTING MATERIALS 9

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors –Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE III DIELECTRIC MATERIALS 7

Dielectric constant – Electric Susceptibility – Types of dielectric polarization – Frequency and temperature dependence of polarization – Internal field and deduction of Clausius-Mosotti's equation(derivation) – Dielectric loss – Types of dielectric breakdown – Uses of dielectric materials (capacitor & transformer).

MODULE IV MAGNETIC MATERIALS 6

Origin of magnetic moment –Types of magnetic materials and their properties – Ferromagnetism – Domain theory of ferromagnetism, hysteresis, soft andhard magnetic materials – Anti ferromagnetic materials (qualitative) – Ferrites– Applications-Magnetic memory – Tapes & magnetic disk drives.

MODULE V SUPERCONDUCTING MATERIALS 6

Superconductivity - BCS theory - Meissner effect - Critical magnetic field - Type I and Type II superconductors - High temperature superconductors - Applications of superconductors: SQUID and magnetic levitation.

MODULE VI OPTICAL AND NEW ENGINEERING MATERIALS 7

Optical properties of semiconductors – Direct and indirect bandgap semiconductors – Color centers, exciton – Luminescence – Fluorescence – Phosphorescence – Liquid crystal display, Solar cell – Electro optic effect-Pockel's effect - Kerr effect – Faraday effect. Metallic

glasses – Preparation, properties and applications - Shape Memory Alloys – Preparation, properties and applications, Nano phase materials – Synthesis, properties and applications.

TOTAL HOURS :45

Text Book:

1. Palanisamy P.K., Physics II, Material Science for ECE, Scitech Publications (India) Pvt Ltd., 2006.
2. Safa O. Kasap, Principles of Electronic materials and devices, McGraw Hill Publishers, 3rd Edition, 2006.
3.

REFERENCES

1. Arumugam.M, Physics II, Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
2. Jacob Millman, Christos C.Halkais, Electronic Devices and Circuits, Tata McGraw-Hill, New Delhi, 1991.
3. Charles Kittel, Introduction to solid state physics, 7th Edition, John Wiley & sons (ASIA) Pvt. Ltd.
4. Sze. S.M., Semiconductor Devices – Physics and Technology, 2nd edn. John Wiley, 2002.
5. Nandita Das Gupta and Amitava Das Gupta, Semiconductor Devices – Modelling and Technology, Prentice Hall of India, 2004.
6. Donald A. Neamen, “Semiconductor Physics and Devices” 3rd Ed., Tata McGraw Hill, 2002.

OUTCOMES:

On completion of this course, the student will be able to

- Choose the correct semi-conductors for electronic devices and display.
- Use dielectric materials for transformers and capacitors
- Use ferromagnetic materials for solid state devices
- Apply the concept of super conductivity for Engineering applications.

GEB1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS 7

Introduction - Units and Dimensions - Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector Algebra and its Physical relevance in Mechanics -Coplanar Forces – Resolution and Composition of forces-Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE 6

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY 6

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Examples

MODULE IV PROPERTIES OF SURFACES 8

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia

MODULE V LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

MODULE VI FRICTION 8

Review of laws of motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

TOTAL HOURS : 60

REFERENCES

1. Beer,F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003

OUTCOMES:

On completion of this course student

- Should be able to resolve forces, moments and solve problems using various principles and laws
- Students should able to understand the concept of equilibrium, kinetics and kinematics and capable of formulating the governing equations to practical problems and provide solutions for those equations

ECB1211	NETWORK ANALYSIS AND SYNTHESIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize on concepts of circuit elements, circuit laws and network reduction
- To understand the steady and transient analysis in RL, RC and RLC circuits.
- To study the significance of two port networks
- To analyze the network in s-domain

MODULE I BASICS OF CIRCUITS AND NETWORKS 7

Ideal sources – Dependent and Independent sources – Linear relation between voltage and current of Network elements – source Transformation – Types of Networks – Network reduction – voltage division – current division – Star – delta transformation.

MODULE II NETWORK THEOREMS 9

Formation of matrix equations and analysis of complex circuits using Mesh current method and nodal method -Thevenin's Theorem- Norton's Theorem-Superposition theorem-Maximum power transfer theorem, substitution theorem, Reciprocity theorem, Millman's theorem, Tellegen's theorem.

MODULE III TRANSIENTS 7

Steady state and transient response- DC response of an R-L Circuit- DC response of an R-C Circuit- DC response of an R-L-C Circuit-Sinusoidal response of an R-L Circuit- Sinusoidal response of an R-C Circuit- Sinusoidal response of an R-L-C Circuit.

MODULE IV TWO PORT NETWORKS 7

Open circuit Impedance (Z) Parameters - short Circuit Admittance(Y) Parameters, Transmission (ABCD) Parameters and Inverse Transmission Parameters-Hybrid (h) Parameters and Inverse Hybrid Parameter- Conversion between parameters-interconnection of two-port networks.

MODULE V NETWORK TOPOLOGY 7

Introduction-Tree and co-tree- Twigs and links-Incidence matrix –properties of Incidence matrix-Tie-set matrix-cut-set –tree branch voltage.

MODULE VI NETWORK SYNTHESIS 8

Properties of Hurwitz polynomials and Positive Real function (PRF) - Synthesis of LC, RL and RC driving point impedance using Foster and Cauer Forms.

TOTAL HOURS : 45

Text Book:

1. William H.Hayt, Jr, J.E.Kemmerly& Steven M.Durban, "Engineering Circuit Analysis" 6th Edition, Mcgraw Hill, 2002

2. A.Sudhakar&ShyammohanS.Palli "Circuits &Network; Analysis& Synthesis", 2nd Edition, Tata McGraw Hill, 1994

3. Someshwar C. Gupta, Jon W. Bayless, BehrouzPeikari, “Circuit Analysis - with computer applications to problem-solving", Wiley-Eastern Ltd., 1991.

4. Van Valkenburg, "Network Analysis", Prentice Hall of India Pvt. Ltd., New Delhi,1994.

REFERENCES

1. M.L Soni& J.C. Gupta, "Electric Circuit Analysis", DhanpatRai& Sons, New Delhi, 1981

2. Joseph Edminister, "Electric Circuits", Schaum's Outline Series, McGrawHill 5th Edition, 2011

3. Franklin F. Kuo, "Network Analysis and Synthesis", John Wiley. 2nd Edition.

OUTCOMES:

After successful completion of the course, student will be able to

- Describe and apply fundamental concepts of network analysis in solving and analyzing different electrical networks.
- Analyze the electrical networks in various network reduction techniques.
- Select appropriate and relevant technique for solving the Electrical network under different conditions.
- Analyze resonant circuits both in time and frequency domains.
- Reconstruct the electrical networks using graph theory
- Synthesize one-port passive networks.

ECB1212	ELECTRON DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the types of semi-conductors
- To describe the working of different diodes, transistors and opto electronicDevice and their applications.
- To analyze the characteristics of diodes and transistors.
- To apply the SPICE software for designing electronic circuits.

MODULE I INTRINSIC AND EXTRINSIC SEMICONDUCTORS 7

Definition of semiconductors, atomic structure of semiconductor, Types of semiconductors-N type and P-type semiconductors - energy band structures-Law of electrical Neutrality-Mass Action Law.

MODULE II PN JUNCTION DIODES 8

Band structure of PN Junction – Current Component in a PN Junction –Derivation of diode equation–Temperature dependence of diode characteristics-Transition and diffusion capacitance –switching characteristics of diode- Avalanche and Zener breakdown - Temperature dependence of breakdown.

MODULE III BIPOLAR JUNCTION TRANSISTORS 9

Construction of PNP and NPN transistors-BJT current components – Emitter to collector and base to collector current gains - Base width modulation- Common Emitter configuration - Common Base configuration – Common collector configuration characteristics-Breakdown characteristic-Ebers-Moll model-Transistor switching times. Applications of BJT - Modeling of CE, CB, CC configuration characteristics using SPICE software.

MODULE IV FIELD EFFECT TRANSISTORS 7

Construction and Characteristics of JFET-Relation between Pinch off Voltage and drain current- Common source configuration characteristics. Applications of JFET - MOSFETS - Enhancement and depletion types. Modeling of Common source configuration characteristics using SPICE software.

MODULE V SPECIAL DIODES & POWER CONTROL DEVICES 7

Varactor diode – Backward diode – Tunneling effect in thin barriers- Tunneldiode – Photo diode - Schottky diodes- Power control devices- Characteristicsand equivalent circuit of UJT - intrinsic standoff ratio- PNPN diode – Twotransistor model, SCR, TRIAC, DIAC.

MODULE VI CCD AND OPTOELECTRONIC DEVICES 7

Charge transfer and charge coupled devices – theory and applications.Semiconductor Opto electronic devices – LED, LASER diode, LCD, OLED,Photo diode Solar Cell. Plasma Devices.

TOTAL HOURS : 45

Text Book:

1. Jacob Millman& Christos C.Halkias, “Electronic Devices and Circuits” Tata McGraw–Hill, 1991.
2. Thomas L.Floyd ,”Electron Devices (Electron Flow Version), 8th edition, Pearson-2008.

REFERENCES

1. Nandita Das Gupta and Amitava Das Gupta, Semiconductor Devices –Modelling and Technology, Prentice Hall of India, 2004.
2. Donald A.Neaman, “Semiconductor Physics and Devices” 3rd Ed., Tata McGraw-Hill 2002.
3. S.Salivahanan, N.Sureshkumar and A.Vallavaraj, Electronic Devices and Circuits,TMH. 1998.
4. S.M.Sze, Semiconductor Devices – Physics and Technology, 2nd edn. John Wiley, 2002.
5. Ben G.Streetman and Sanjay Banerjee, Solid State Electronic Devices, PearsonEducation 2000.

OUTCOMES:

On completion of the course the students will be able to

- Summarize the basics of semiconductors.
- Know the operation of optoelectronic devices.
- Demonstrate the application of diodes and transistors.
- Analyze the characteristics of BJT, FET, Power control devices and Diodes.
- Model the electronic circuits using simulation software.
- Explain the operation of all the types of electronic devices

SSB1182	SOCIOLOGY, ETHICS AND HUMAN VALUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the fundamental and basic concepts of Sociology.
- To illustrate how society evolved in India with changes in social strata.
- To explain the importance of groups, teams in industrial spheres.
- To develop the knowledge of social impact of economic liberalization and technology.
- To state some basic concepts on ethics, values and human rights.
- To develop social responsibility & human professional ethics.
- To recognize and determine the role of engineers in the economic and social development of the society.

MODULE I FUNDAMENTALS OF SOCIOLOGY 8

Sociology - definition, evolution, scope- Basic concepts-Social Process-Sociological theories, Social Institutions – family, economic, politics, religion, education, culture, Social Stratification, Socialization & Social Control.

MODULE II SOCIOLOGY IN INDIAN CONTEXT 7

Development in India– Caste & Classes – Women and Society – impact of social laws, Social Change in contemporary India – Secularism and Communalism – Social Exclusion and Inclusion.

MODULE III INDUSTRIAL SOCIOLOGY 7

Definition and perspectives – Industry in India – Social groups in industry – Behavior pattern, Group Dynamics – team, enhancing group behaviour. Industrial Organization - formal and informal organizations, Line and staff organizations - functions.

MODULE IV INDUSTRIAL – SOCIETY INTERFACE 8

Perspectives – Social responsibilities – Sociological effect on industrialization– urbanization, child labour, psychological impact, Impact of technology, Modernization – Globalization – challenges, Role of engineers.

MODULE V ETHICS AND HUMAN VALUES 7

Ethics and values – Organizational values – personal worth, ethical behavior, Professional ethics-professional rights and responsibilities, Whistle blowing, International ethics, Corruption.

MODULE VI ENGINEERS AND SOCIETY 8

Quality of life and society – engineer in economic development, Technology development – invention, innovation and diffusion, Appropriate Technology– Engineer's contribution, Ecology and environment –Sustainable development– Role of engineers.

TOTAL HOURS : 45

Text Book:

1. Samir Das Gupta and Paulomi Saha, An Introduction to Sociology, Pearson, Delhi, 2012.
2. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
3. Vidya Bhushan and D.R. Sachdeva, Fundamentals of Sociology, Pearson, Delhi, 2012.
4. Deshpande, Satish, Contemporary India : A Sociological view, Viking (2002)
5. Thopar, Romila, Early India, Penguin (2003).
6. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 1996.
7. Haralambos, Heald R.M, Sociology Themes and Perspectives, Oxford, New Delhi-92.
8. Ram Ahuja, Social Problems in India,Rawat Publications, New Delhi

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals and the basic concepts of Sociology.
- Students will have gained knowledge about the reality of the society.
- Students will be able to positively respond to the forces of change.
- Students will inculcate common interests of the group and adopt legitimate means to achieve them.
- Students will have knowledge about the impact of technology, modernization, and globalization.
- Students will be able to conform to the rules of the society and communicate effectively with the engineering community and with the society at large
- Students will work effectively as individuals, in teams and in multi-disciplinary settings together with the capacity to undertake holistic development of the society.

ENB1282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To teach them formal and informal expressions in business communication.
- To teach them formal and informal expressions in business communication.
- To teach them formal and informal expressions in business communication.
- To expose them to the process of different kinds of formal writing.
- To train them in using the nuances of writing in corporate correspondence.
- To train them in writing effective applications with résumé and reports.

MODULE I **4**

Introduction - process of writing – ABC of academic and professional writing –Instructions and recommendations

Reading business related texts for specific information.

MODULE II **4**

Format and conventions of writing email, memo & fax.

Writing email (Case study), memo, fax, agenda and minutes of the meeting (using mobile applications)

MODULE III **6**

Format and conventions of writing agenda and minutes of the meeting Letter Writing-Calling for an interview & letter of inquiry

MODULE IV **6**

Writing letter of application and Résumé - Different types – Functional, Chronological Writing one's résumé using Wikispaces

MODULE V **6**

Reporting an incident, writing a feasibility report, and progress report & discipline specific reports.

Reading a case study (industry specific) – collaborative writing using Wikispaces

MODULE VI **4**

Writing Statement of purpose– Assessing one's strengths and weaknesses & self and peer evaluation of strengths.

TOTAL HOURS : 30

REFERENCES :

1. Riordan, D (2013). Technical Report Writing Today. Cengage Learning, 10th edition. USA.
2. Oliu, W.E., Brusaw, C.T., & Alred, G.J.(2012). Writing that Works: Communicating Effectively on the Job . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). HBR Guide to Better Business Writing (HBR Guide Series). Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). Business Correspondence and Report Writing. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). Academic and Professional Writing for Teachers. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Create different types of academic and professional documents by using the three stages of writing.
- Identify content specific vocabulary and also use them in appropriate contexts.
- Use formal and informal expressions in real life situations.
- Demonstrate reading skills with reference to business related texts.
- Compose written correspondence effectively in work place contexts.
- Write effective letter of applications, résumé and reports.

ECB1213	ELECTRON DEVICES LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

The purpose of this course is to introduce students to

- Analyze the fundamental characteristics of various Semiconductor Devices.
- Apply the SPICE simulation software for electronic circuit analysis.
- Justify the practical observations with theoretical values

LIST OF EXPERIMENTS

1. PN Junction Diode characteristics.
2. Zener Diode characteristics.
3. Applications of Diode as Clipper and Clamper.
4. Input and Output characteristics of BJT in CB configuration.
5. Input and Output characteristics of BJT in CE configuration.
6. Characteristics of JFET.
7. Switching Characteristics of Diode & BJT
8. UJT Characteristics.
9. SCR Characteristics.
10. DIAC Characteristics.
11. TRIAC Characteristics
12. Characteristics of Photo diode and Photo transistor.

OUTCOMES:

On completion of this course the student will be able to

- Find the working condition of any electron device
- Apply the biasing techniques in electronic circuits
- Experimentally obtain the characteristics of basic semi-conductor device.
- Analyse the characteristics of basic semiconductor devices and validate with semiconductor results.
- Experimentally determine the important parameter values of basic semiconductor devices.
- Demonstrate mini projects using basic electron devices.

PHB1284	PHYSICS OF ENGINEERING MATERIALS LABORATORY	L	T	P	C
	(Common to ECE, EEE, AERO, CSE & IT Branches)	0	0	2	1

OBJECTIVES:

- To study the characteristics of conducting, semiconducting, dielectric, magnetic and optical materials.

LIST OF EXPERIMENTS:

1. Determination of magnetic field along the axis of a circular coil – Stewart and Gees experiment.
2. Determination of electrical conductivity of a given metal by four point probe method.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of band gap of a semiconductor diode.
5. Determination of dielectric loss of a dielectric material using LCR bridge method.
6. Determination of time constant of an RC circuit by charging and discharging of a capacitor.
7. Determination of magnetic susceptibility of a paramagnetic material using Quincke's method.
8. Determination of energy loss of a given transformer coil using Hysteresis – B-H curve.
9. Determination of Verdet constant of a material using Faraday Effect.
10. Determination of Kerr constant using electro optic modulators.

OUTCOMES:

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

- Know the properties of conducting, semiconducting, dielectric and magnetic materials.
- Know the principle and working of Kerr modulator and Faraday rotator.

SEMESTER III

MAB2181	**TRANSFORMS AND APPLICATIONS**	**L**	**T**	**P**	**C**
	(Common to all B.Tech Programmes)	**3**	**1**	**0**	**4**

OBJECTIVES:

The course aims to

- develop the skills of the students in the areas of boundary value problems and transform techniques.
- acquire knowledge on different transforms like Laplace Transform, Fourier Transform and Z Transform.

MODULE I LAPLACE TRANSFORM 8

Laplace transform - sufficient condition - Transforms of elementary functions-Properties - Transforms of Derivatives and Integrals - Initial and Final Value Theorem - Transform of Periodic functions - Inverse transforms - Convolution Theorem.

MODULE II FOURIER SERIES 7

Dirichlet's conditions - General Fourier series - Odd and even functions - Half-range sine series - Half-range cosine series - Complex form of Fourier Series-Parseval's identity - Harmonic Analysis.

MODULE III BOUNDARY VALUE PROBLEMS 8

Classification of second order quasi linear partial differential equations - Solutions of one dimensional wave equation - One dimensional heat equation-Steady state solution of two-dimensional heat equation (Insulated edges excluded) - Fourier series solutions in Cartesian coordinates.

MODULE IV FOURIER TRANSFORM 7

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

MODULE V Z -TRANSFORM AND DIFFERENCE EQUATIONS 7

Z-transform - properties – Inverse Z–transform – Convolution theorem - Formation of difference equations.

MODULE VI APPLICATIONS OF TRANSFORMS 8

Applications of Laplace Transform in solving linear ordinary differential equations- Second order with constant coefficients, Simultaneous First order equations - Applications of Z-transform in solving difference equations using Z-transform.

TOTAL HOURS : 60

Text Book:

1. Veerarajan.T., "Engineering Mathematics", 5th Edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, New Delhi, 2012.

REFERENCES

1. Kreyszig .E., "Advanced Engineering Mathematics",10th Edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th Edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", 1st Edition, Academic Press, USA, 2002.
5. Ramana B.V, "Higher Engineering Mathematics", 4th Edition,Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

OUTCOMES:

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

- Solve Engineering problems in the area of heat conduction, communication systems, electro-optics and electromagnetic theory using different transforms.
- Solve Boundary value problems encountered in engineering practices.

SSB2181	LAW FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the Indian Constitution and Governance of our country.
- To explain human rights, local and International and redressal mechanism.
- To discuss the important aspects of Corporate laws.
- To state the importance of industrial and labour laws of our country.
- To present the laws on contracts and arbitration.
- To state the importance of laws related to intellectual property.

MODULE I INDIAN CONSTITUTION 7

Constitution – meaning and history – making of constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Equality and social justice, Directive principles, Constitutional amendments.

MODULE II GOVERNANCE AND POWERS VESTED 7

Union executive, Legislature – Union – State and union territories, Union and state relations, powers vested with parliament and state legislature, emergency provisions - People's Representations Act – Election Commission – Election for parliament and state legislature, Judiciary.

MODULE III HUMAN RIGHTS 7

Human rights – meaning and significance, International law on human rights, Covenant on civil and political rights; Covenant on Economic, social and cultural rights – protocol, UN mechanism and agencies, watch on human rights and enforcement – role of judiciary and commission, Right to information Act 2005 – evolution – concept – practice.

MODULE IV CORPORATE AND LABOUR LAWS 7

Corporate laws – meaning and scope – laws relating to companies, Companies Act 1956 – collaboration agreement for Technology transfer, Corporate liability – Civil and criminal – Industrial employment (standing orders) Act 1946, Industrial Disputes Act, 1947, Workmen's Compensation Act 1923, The Factories Act, 1948 – Industry related other specific laws.

MODULE V CONTRACTS AND ARBITRATION 9

Types of contract – standard form of contracts - General principles under Indian Contract Act, 1872 – protection against exploitation – judicial approach to contracts, Arbitration and conciliation – meaning, scope and types, model law, judicial intervention, International commercial arbitration – arbitration agreement, arbitration tribunal – powers and jurisdiction, enforcement and revision, Geneva Convention, Awards, Confidentiality.

MODULE VI LAWS RELATED TO IPR 8

IPR – meaning and scope, International Convention – Berne and Parrys Conventions, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent

and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator, Securing of International patents.

TOTAL HOURS : 45

REFERENCES

1. Jain M.P, Indian Constitutional Law, Wadhwa & Co., (2005)
2. Subhash G. & Kashyap, Our Constitution : An introduction to India's Constitution and Constitutional Law, National Book Trust, 3rd edn., India (2001)
3. Agarwal H.D., International Law and Human Rights, Central Law Publications, (2008).
4. Meena Rao, Fundamental Concepts in Law of Contract, 3rdedn., Professional offset, (2006).
5. Ramappa, Intellectual Property Rights Law in India, Asia Law House (2010)
6. Avtar Singh, Company Law, Eastern Book Co., (2007).
7. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House.
8. Acts : Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of the course

- Students will be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have developed knowledge in judiciary, human rights, cultural, social and political rights.
- Students will have synthesized knowledge about the corporate and labour laws, contracts, arbitration and laws related to Intellectual Property Rights.

CSB2181	DATA STRUCTURES USING C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide Programming knowledge in Object Oriented Programming.
- To expose to the basic concepts of Data structures and abstract data types.
- To understand the algorithms related to Trees, Graphs, Searching and Sorting.

MODULE I OBJECT ORIENTED PROGRAMMING 7

Object oriented programming paradigm - Concepts - Applications of OOP - Structure of a C++ program- Operator and control structures- Functions.

MODULE II CLASSES AND OBJECTS 8

Class Definition, Classes and Objects, - attributes -Access specifiers, Data Members, Member Functions, Private and Public Members, Arrays - Structure & classes, Friend function, Inline function, Scope resolution - constructors - Destructors - Pointers.

MODULE III OPERATOR OVERLOADING AND INHERITANCE 8

Overloading: Rules for overloading Operators and Methods - Defining derived classes - Single inheritance - Multilevel inheritance - Multiple inheritance - Hierarchical inheritance - Hybrid inheritance

MODULE IV DATA STRUCTURES AND ABSTRACT DATA TYPES 7

Data and Information - Data Structure Types - Concept of Data Types - Abstract Data Types- - List ADT - Stack ADT - Queue ADT - Singly Linked List - Double Linked List - Stack and Queue using Linked List - Circular Queue

MODULE V TREES & GRAPHS 8

Binary Trees - Search Tree ADT - Binary Search Tree - Tree Traversals - Terminologies of Graphs - Graph Traversals - Shortest Path Algorithm - Dijkstra's Algorithm - Spanning Trees - Prim's Algorithm - Kruskal's Algorithm - Depth First Search - Breadth First Search - Undirected Graphs - Biconnectivity

MODULE VI SEARCHING AND SORTING 7

Linear Search - Binary Search - Insertion Sort - Selection Sort - Shell sort - Bubble Sort - Heap sort - Merge sort- Quick sort

TOTAL HOURS : 45

Text Book:

1. Matt Weisfeld," Object-Oriented Thought Process", 4th Edition, Pearson Education, 2013.
2. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of data structures in C++", 1st Edition,Galgotia Publications, 2006

REFERENCES

1. B. Trivedi, "Programming with ANSI C++", 3rd Edition,Oxford University Press, 2007.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles", 2nd Edition, Create Space Independent Publishing Platform, 2011.

OUTCOMES:

Upon successful completion of this course, the student will be able to

- Analyse and design algorithms and write programs in an Object Oriented Approach.
- Design and implement effective data structures for a given problem.

ECB2101	ELECTRONIC CIRCUITS - I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To recall the basics of devices working principle and characteristics.
- To describe about BJT, JFET and MOSFET biasing concepts.
- To describe design and analysis of BJT, JFET and MOSFET amplifiers
- To measure amplifiers AC and DC parameters with and without loads
- To summarize IC MOSFET amplifiers

MODULE I RECTIFIERS AND REGULATORS 7

Analysis of half wave, Center tap Full wave and Bridge – Full wave Rectifiers without filters and with C, L, L-C and C-L-C filters, series and shunt regulators.

MODULE II BIASING OF DISCRETE BJT, JFET AND MOSFET 9

DC Load line, operating point, various biasing methods for BJT-Design-Stability-Bias compensation, Thermal stability, Design of biasing for JFET, Design of biasing for MOSFET

MODULE III BJT AMPLIFIERS 9

Small signal Analysis of Common Emitter, Common Collector and commonBaseamplifiers.AC Load line, Voltage swing limitations, Differential amplifiers-CMRR Darlington Amplifier- Bootstrap technique - Cascaded stages - Cascode Amplifier.

MODULE IV JFET AND MOSFET AMPLIFIERS 7

Small signal analysis of JFT amplifiers- Small signal Analysis of MOSFET and JFET Common source amplifier, Voltage swing limitations, Small signal analysis of MOSFET and JFET Source follower and Common Gate amplifiers, BiCMOS Cascode amplifier.

MODULE V FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS 7

Low frequency and Miller effect, High frequency analysis of CE and MOSFETCS amplifier, Short circuit current gain, cut off frequency fα and fβ unity gain and Determination of bandwidth of single stage and multistage amplifiers

MODULE VI IC MOSFET AMPLIFIERS 8

IC Amplifiers - IC biasing Current steering circuit using MOSFET- MOSFET current sources-PMOS and NMOS current sources. Amplifier with active loads– Enhancement load, Depletion load and PMOS and NMOS current sources load- CMOS common source and source follower.

TOTAL HOURS : 45

Text Book:

1. Donald .A. Neamen, Electronic Circuit Analysis and Design 2nd edition, Tata McGraw Hill, 2009.
2. Adel .S. Sedra, Kenneth C. Smith, Micro Electronic circuits, 6th Edition, Oxford University Press, 2010.

REFERENCES

1. David A. Bell Electronic Devices and Circuits, Oxford Higher Educationpress, 5th Edition, 2010
2. Behzad Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill, 2007.
3. Millman .J. and Halkias C.C, Integrated Electronics, McGraw Hill, 2001.
4. D.Schilling and C.Belove, Electronic Circuits, 3rd edition, McGraw Hill, 1989.

OUTCOMES:

- Describe current-voltage characteristics, large signal models for diodes, bipolar and MOS type of transistors and use them in the design and analysis of rectifier and regulator circuit.
- Analyze and design circuits using transistors as amplifier and switch with the concepts of load lines and operating points.
- Use small signal models to calculate gain, input and output resistance for basic transistor amplifiers of bipolar and MOS type.
- Calculate frequency response curves and to interpret the salient features in terms of poles and zeros for basic transistor amplifiers of bipolar and MOS type.
- Analyze the different amplifier design topologies used in IC Amplifier design and its pros and cons.
- Configure suitable amplifier for electronic projects.

ECB2102	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the students to the concept of Signals and Linear Time-Invariant Systems
- To illustrate various mathematical tools such as Fourier, Laplace, z-Transform etc. for signal processing applications

MODULE I INTRODUCTION TO SIGNALS 8

Time-Domain Representation of Discrete and Continuous Signals. Standard elementary signals - unit step, unit ramp, sinusoidal, unit impulse signal and complex-exponential signal. Basic Time-Domain operations on signals. Addition, Multiplication, Differentiation, Integration, and convolution of signals. Signal Measurements - mean, median, standard deviation, energy, power and correlation of signals. Signal Classification and Symmetry. Periodicity of discrete-time signals. Synthesis of simple signals.

MODULE II INTRODUCTION TO SYSTEMS 8

Continuous-Time and Discrete-Time Systems. Characteristics of Systems. Linear and Time-Invariant (LTI) Systems. Properties of LTI System. Impulse Response, convolution sum and convolution integral. Interconnection of LTI Systems. Differential and Difference Equation representation of LTI systems.

MODULE III FOURIER SERIES AND FOURIER TRANSFORM ANALYSIS 7

Fourier Series representation of signals. Properties of Fourier Series. Continuous-Time Fourier Transform and its properties. Frequency Response of CT-LTI Systems. Discrete-Time Fourier Transform (DTFT) and its properties. Discrete Fourier Transform (DFT) and its properties.

MODULE IV LAPLACE TRANSFORM ANALYSIS 7

Unilateral and Bilateral Laplace Transform. Region of Convergence (ROC), Properties of Laplace Transforms. Poles and Zeros. Inverse Laplace Transformation. Solving Differential Equations with Initial Conditions. The Transfer Function and Frequency Response of CT-LTI Systems. Bode Plots

MODULE V Z- TRANSFORM ANALYSIS 8

Z-Transform. z-Plane and ROC. Properties of z-Transform. Poles and Zeros. Methods for Inversion of z-Transform. Transfer Function of DT-LTI Systems. Causality and Stability. Computational Structures for Implementing Discrete-Time LTI systems

MODULE VI MULTI-DIMENSIONAL SIGNALS AND SAMPLING 7

Representation of Two-dimensional signals, Images. Introduction to 2-D Fourier Transform and 2-D Filters. Ideal Sampling of Continuous-Time signals, Reconstruction and Sampling Theorem and Nyquist's rate.

L:45, T:15

TOTAL HOURS 60:

Text Book:

1. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, John Wiley & Sons Pvt Ltd., 2004.
2. Alan V. Oppenheim, Alan S. Willsky , S. Hamid Nawab, "Signals & Systems", 2nd Edition, Pearson Education, 1997.
3. Hwei P. Hsu, "Signals And Systems", 2nd Edition,Schaum's Outlines, McGraw Hill, 1995.

REFERENCES

1. M. J. Roberts, "Signals and Systems Analysis using Transform method and MATLAB", 1st Edition,Tata McGraw Hill, 2003.
2. K. Lindner, "Signals and Systems", 2nd Edition, McGraw Hill International, 1999.
3. Chi-Tsong Chen, "Signals and Systems", 3rd Edition, Oxford University Press, 2004.
4. Roger E. Ziemer, William H. Tranter, D.R. Fannin, "Signals & Systems: Continuous and Discrete", 4th Edition, Prentice Hall, 1998.
5. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms and Applications", 3rd Edition, Prentice Hall of India, 2000.
6. Ashok Amhardar, "Analog and Digital Signal Processing", 2nd Edition, Thomson, 2002.

OUTCOMES:

On completion of the course the students will be able to

- Mathematically represent and classify the signals
- Evaluate and manipulate signals mathematically.
- Identify, and characterize common LTI Systems.
- Apply the tools such as Fourier Transform, Laplace Transform, and z-Transformin problem solving.
- Synthesize discrete-time systems from basic component blocks.
- Use sampling and Nyquist’s theorems for multi-dimensional signals.

ECB2103	ELECTROMAGNETIC FIELDS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To explain the fundamentals of static electric and magnetic fields.
- To describe how materials affect electric and magnetic fields
- To interpret the relation between the fields under time varying situations.
- To introduce principles of propagation of uniform plane waves.

MODULE I VECTOR ANALYSIS AND COORDINATE SYSTEM 5

Scalar and vector quantities, Representation of vectors, scalar and vector fields, Co-ordinate System - Rectangular, Cylindrical and Spherical Coordinate System - Introduction to line, Surface and Volume Integrals - Definition of Curl, Divergence and Gradient - Meaning of Stokes theorem and Divergence theorem. Coulomb's Law in Vector Form - Definition of Electric Field Intensity - Principle of Superposition.

MODULE II STATIC ELECTRIC FIELD 8

Electric Field due to discrete charges - Electric field due to continuous charge distribution - Electric Field due to charges distributed uniformly on an infinite and finite line - Electric Field on the axis of a uniformly charged circular disc - Electric Field due to an infinite uniformly charged sheet. Electric Scalar Potential-Relationship between potential and electric field - Potential due to infinite uniformly charged line - Potential due to electrical dipole - Electric Flux Density - Gauss Law - Proof of Gauss Law - Applications.

MODULE III STATIC MAGNETIC FIELD 7

The Biot-Savart Law in vector form - Magnetic Field intensity due to a finite and infinite wire carrying a current I - Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I - Ampere's circuital law and simple applications. Magnetic flux density - The Lorentz force equation for a moving charge and applications - Force on a wire carrying a current I placed in a magnetic field - Torque on a loop carrying a current I.

MODULE IV ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 9

Poisson's and Laplace's equation - Electric Polarization-Nature of dielectric materials-Definition of Capacitance - Capacitance of various geometries using Laplace's equation - Electrostatic energy and energy density - Boundary conditions for electric fields - Electric current - Current density - point form of ohm's law - continuity equation for current. Definition of Inductance - Inductance of loops and solenoids - Definition of mutual inductance - simple examples. Energy density in magnetic fields - Nature of magnetic materials - magnetization and permeability - magnetic boundary conditions.

MODULE V TIME VARYING ELECTRIC AND MAGNETIC FIELDS 7

Faraday's law - Maxwell's Second Equation in integral form from Faraday's Law –Equation expressed in point form. Displacement current - Ampere's circuital law in integral form - Modified form of Ampere's circuital law as Maxwell's first equation in integral form - Equation expressed in point form. Maxwell's four equation in integral form and differential form.

Poynting Vector and the flow of power - Power flow in a co-axial cable - Instantaneous Average and Complex Poynting Vector

MODULE VI ELECTROMAGNETIC WAVES 9

Derivation of Wave Equation - Uniform Plane Waves - Maxwell's equation in Phasor form - Wave equation in Phasor form - Plane waves in free space and in a homogenous material.Wave equation for a conducting medium - Plane waves in lossy dielectrics - Propagation in good conductors - Skin effect. Linear, Elliptical and circular polarization - Reflection of Plane Wave from a conductor-normal incidence - Reflection of Plane Waves by a perfect dielectric - normal and oblique incidence. Dependence on Polarization. Brewster angle.

L:45, T:15

TOTAL HOURS : 60

Text Book:

1. William H.Hayt "Engineering Electromagnetics", 6th Edition,Tata McGraw - Hill, 2003.
2. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems," Prentice Hall of India 2nd Edition, McGraw-Hill, 2003.

REFERENCES

1. M.N.O.Sadiku: "Elements of Engineering Electromagnetics", 4th Edition, Oxford University Press, 2007.
2. Ramo, Whinnery and Van Duzer: "Fields and Waves in Communications Electronics", 3rd Edition, John Wiley & Sons, 2003
3. Narayana Rao, N : "Elements of Engineering Electromagnetics", 4th Edition, Prentice Hall of India, New Delhi, 1998.
4. David K.Cheng: "Field and Wave Electromagnetics", 2nd Edition, Pearson Edition, 2004.

OUTCOMES:

On completion of the course the students will be able to

- Recall the basic laws of Electromagnetic theory State and apply the principles of electric and magnetic field in different coordinate systems.
- Develop field equations for electric and magnetic fields of any geometry.
- Solve the static and time varying electric and magnetic fields for practical applications.
- Apply the concept of electric and magnetic fields in materials.
- Analyze the wave propagation in different medium.
- Describe the concepts of electromagnetic theory.

ENB2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To empower students with soft skills for employability.
- To help students speak effectively.
- To expose them to a range of business contexts through podcasts for learning appropriate expressions and using them effectively.
- To enable them to make effective presentations.
- To help them learn persuasive and negotiating skills.
- To train them in deliberating on current affairs efficiently by participating in group discussions.
- To prepare them for job interviews.

MODULE I **4**

Training in soft skills-Importance of Oral Communication, rubrics for evaluation, Verbal and non-verbal communication, One-minute presentations & Just a minute (JAM)

Paralinguistic features - Listening to short conversations and monologues for relevant information.

MODULE II **6**

Role-play, Selling a product , marketing skills (Case study on advertisements)

Listening to Business English podcast, Negotiation, persuasion and marketing skills

MODULE III **4**

Deliberation on social and scientific issues & Debates (Peer and Faculty feedback)

Viewing video samples on debates, TED Talks

MODULE IV **4**

Pair work- Think, pair and share activity-analyzing & Problem solving

Listening for specific information and taking short notes

MODULE V **6**

Discussion etiquette -Assigning different roles in a GD (Peer and Faculty feedback) Goal setting, Assessing one's strengths and weaknesses & SWOC Analysis

MODULE VI **6**

Mock interview (Peer and Faculty feedback) - Types of Job Interview – Telephone Interview, Stress Interview (Case study) Listening to interviews for understanding speakers' opinions

TOTAL HOURS : 30

REFERENCES:

1. Hancock, Mark (2012). English Pronunciation in Use. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). Study Speaking: A Course in Spoken English for Academic Purposes (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). Personality Development. Tata McGraw Hill, New York.
4. Dhanavel, S.P (2015). English and Soft Skills. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Apply various soft skills to deal with any professional situation.
- Speak English intelligibly, fluently and accurately.
- Use a range of expressions appropriate to the situations.
- Make effective presentations.
- Use persuasive and negotiating skills for marketing products.
- Deliberate on current affairs with confidence.
- Participate effectively in group discussions and interviews.

CSB2182	DATA STRUCTURES USING C++ LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To implement the basic concepts of object oriented programming using C++.
- To understand basic ADTs such as arrays and linked lists.
- To design and implement operations on stacks, queues, trees and graphs.
- To design and implement algorithms for searching and sorting, Trees and Graphs.

LIST OF EXPERIMENTS

1. Classes, Object and Constructors.
2. Arrays and related operations.
3. Pointers and related operations.
4. Overloading - Operators and Methods.
5. Inheritance.
6. List ADT - implementation of Stacks, Queues.
7. Singly Linked List - implementation of Stacks, Queues.
8. Binary tree - traversals.
9. Implementation of search algorithms - linear search and Binary Search.
10. Implementation of sorting algorithms (selection sort, bubble sort, quick sort).
11. Representation of graph and traversal algorithm (DFS & BFS).

OUTCOMES:

Students who complete this course will be able to:

- Understand the object-oriented approach in programming.
- Understand and design appropriate data structures to solve a given problem.
- Design and implement operations on arrays, linked lists, stacks and queues.
- Design and write algorithms for traversing trees and graphs.

ECB2104	ELECTRIC CIRCUITS – I LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

The purpose of this course is to introduce students to

- Understand Bias in Amplifier circuits
- Experiment the characteristic of CE, CB and CC Amplifier
- Experiment the frequency response of CS Amplifiers
- Experiment the Transfer characteristic of differential amplifier
- Experiment the frequency response characteristics of multistage amplifiers
- Develop SPICE simulation of Electronic Circuits

MODULE I

1. Study of BJT Biasing Circuits - Fixed Bias, Self- Bias, Voltage Divider Bias and Collector feedback bias.
2. Study of FET Biasing Circuits - Fixed Bias, Self- Bias, Voltage Divider Bias.
3. Design & Determination of frequency response, input impedance and output impedance of CE amplifier.
4. Determination of Mid band Voltage gain, input impedance and output impedance of CC amplifier.
5. Determination of frequency response, input impedance and output impedance of Two stage RC Coupled Amplifier.
6. Determination of Mid band Voltage gain, input impedance and output impedance of Darlington amplifier.
7. Determination of frequency response, input impedance and output impedance of Cascode amplifier.
8. Determination of CMRR of Differential amplifier.
9. Determination of frequency response, input impedance and output impedance of CS amplifier.
10. Design &Study of Class B Complementary Symmetry Power amplifier.
11. Determination of Ripple factor of HWR & FWR with and without filter.
12. Design & Study of Series and Shunt voltage regulators.
13. Spice Simulation of Common Emitter and Common Source amplifiers

OUTCOMES:

On completion of this course the student willbe able to:

- Apply Knowledge of basic components working and impact of stability factor, operating points to assure the stable operation of active components.
- Develop the capability to analyze and design voltage regulator circuits using Zener diodes.
- Develop the capability to analyze and design simple amplifier circuits using BJT and FET
- Determine CMRR of differential amplifier.
- Use the techniques, skills and modern engineering simulation tools such as multisim, necessary for engineering practice
- Implement mini project using regulators and amplifiers.

SEMESTER IV

MAB2214	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- This course aims at providing the necessary basic concepts in random processes.

MODULE I PROBABILITY CONCEPTS 7

Axioms of probability - Addition and Multiplication Theorem - Conditional probability - Total probability - Baye's theorem.

MODULE II RANDOM VARIABLES 7

Random variable - Probability mass function - Probability density functions - Properties - Moments - Moment generating functions and their properties.

MODULE III STANDARD DISTRIBUTIONS 8

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, and Normal distributions and their properties - Functions of a random variable.

MODULE IV TWO DIMENSIONAL RANDOM VARIABLES 8

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and regression - Transformation of random variables - Central limit theorem.

MODULE V CLASSIFICATION OF RANDOM PROCESSES 7

Definition and examples - first order, second order, strictly stationary, wide - sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

MODULE VI CORRELATION AND SPECTRAL DENSITIES 8

Auto correlation - Cross correlation - Properties - Power spectral density - Cross spectral density - Properties - Wiener-Khintchine relation - Relationship between cross power spectrum and cross correlation function - Linear time invariant system - System transfer function -Linear systems with random inputs - Auto correlation and cross correlation functions of input and output.

TOTAL HOURS : 60

Text Book:

1. Sheldon M. Ross, "Introduction to Probability Models", 10th Edition, Academic Press, USA, 2009.
2. Peebles Jr. P.Z., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill Publishers, 4th Edition, New Delhi, 2002. (Chapters 6, 7 and 8).

REFERENCES

1. Henry Stark and John W. Woods "Probability and Random Processes with Applications to Signal Processing", 3rd Edition, Pearson Education, Delhi, 2002.
2. Ochi, M.K., "Applied Probability and Stochastic Process", 2nd Edition, John Wiley & Sons,New York, 1990.
3. Howard M.Taylor and Samuel Karlin," An Introduction to Stochastic Modeling", 3rd Edition, Academic Press, USA, 1998.
4. Athanasios Papoulis, S. Unnikrishna Pillai, "Probability, random variables, and stochastic processes", 4th Edition, Tata McGraw-Hill Education, Delhi, 2008.

OUTCOMES:

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

- Solve real life problems using standard distributions.
- Characterize phenomena which evolve with respect to time in probabilistic manner.
- Analyze the response of random inputs to linear time invariant systems.

ECB211	ELECTRONIC CIRCUITS II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about feedback amplifiers
- To explain the design concepts of Oscillators, Tuned amplifiers, wave shaping circuits, multivibrators, blocking oscillators and time based generators.

MODULE I FEEDBACK AMPLIFIERS AND STABILITY 7

Basic feedback concepts - Properties of Negative feedback - Four feedback topologies with amplifier circuit. Examples - Analysis of series - shunt feedback amplifiers - stability problem - Frequency compensation.

MODULE II OSCILLATORS 7

Barkhausen criteria for oscillator - Analysis of RC oscillators - Phase shift Wein bridge oscillators - LC oscillators - Colpitt, Hartley, Clapp, Crystal , Armstrong, Franklin and Ring Oscillators.

MODULE III LARGE SIGNAL AMPLIFIERS 7

Classification of large signal amplifiers – Class A large signal amplifiers Transformer coupled class A audio power amplifier and Efficiency – Class B amplifier - Push-pull amplifier – Complementary Symmetry push-pull amplifier and Efficiency – Class C amplifier and Efficiency – Thermal stability and heat sink.

MODULE IV TUNED AMPLIFIERS 7

Basic principles - Inductor losses - Use of transformers - Single tuned amplifier frequency analysis - Amplifier with multiple tuned circuits - Cascade - Synchronous tuning - Stagger tuning - Stability of tuned amplifiers using Neutralization techniques.

MODULE V WAVE SHAPING AND MULTIVIBRATOR CIRCUITS 8

RL & RC Integrator and Differentiator circuits. Diode clippers, clampers and slicers. Collector coupled and Emitter coupled Astable multivibrator. Monostablemultivibrator.Bistablemultivibrators.Triggeringmethods.Storage delay and calculation of switching times. Speed up capacitors. Schmitt trigger circuit.

MODULE VI BLOCKING OSCILLATORS AND TIME BASE GENERATORS

Pulse transformers, Monostable Blocking Oscillators using Emitter and base timing. Frequency control using core saturation. Astable blocking oscillator, UJT saw tooth generators. Bootstrap and Miller saw-tooth generators. Voltage sweep generators - Current sweep generators.

TOTAL HOURS : 45

Text Book:

1. Millman and Halkias. C., "Integrated Electronics", 1st Edition, Tata McGraw-Hill, 1991
2. Schilling and Belove, "Electronic Circuits", 3rd Edition,TMH, 2002

3. Millman J. and Taub H., "Pulse Digital and Switching waveform", 3rd Edition McGraw-Hill International, 2000.

REFERENCES

1. Sedra and Smith, "Micro Electronic Circuits", 5th Edition, Oxford University Press, 2004

2. David A. Bell, "Solid State Pulse Circuits ", 3rd Edition, Prentice Hall of India, 1992

OUTCOMES:

On completion of the course the students will be able to

- Design Amplifier and Oscillator circuits.
- Make use of Amplifier and Oscillator in electronic systems.
- Interpret the parameters of Amplifier and Oscillator circuits.
- Analyze various parameters of Amplifier and Oscillator in analog circuits.
- Design and formulate new results to meet desired specifications of electronic systems
- Implement Amplifier and Oscillator circuits.

ECB2212	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the basic laws of Boolean algebra.
- To introduce the methods for simplifying Boolean expressions.
- To learn the procedures for the analysis and design of combinational circuits and sequential circuits.
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concepts of HDL

MODULE I BOOLEAN ALGEBRA AND LOGIC GATES 8

Binary number systems- Binary Arithmetic- Binary codes-Boolean algebra and theorems-Boolean functions- Karnaugh map and Quine- McCluskey Method-Logic gates. Implementations of Logic Functions using gates.

MODULE II COMBINATIONAL CIRCUITS 8

Analysis and design procedures- Circuits for arithmetic operations - Multiplexer/ Demultiplexer- Encoder / decoder - Parity checker- Code converters.

MODULE III SEQUENTIAL CIRCUITS 10

Flip flops SR, JK, T, D, Master slave – Characteristic table, Edge triggering – Level Triggering –Conversion of flip flops, Counters: Definition – Types - Asynchronous Counters - Synchronous counters- - Design of counters, Design of Shift registers, Classification of sequential circuits - Moore and Mealy circuits.

MODULE IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 6

Analysis and Design of Asynchronous sequential circuits, Hazards, Hazards elimination.

MODULE V MEMORY DEVICES AND IC FAMILIES 6

Memory devices and organization- Programmable Logic Devices-digital IC Families - Implementation of combinational logic using MUX, ROM, PAL and PLA.

MODULE VI VERILOG HARDWARE DESCRIPTION LANGUAGE 7

Introduction to VerilLog HDL, Language Constructs and Conventions, Gate Level Modeling , Modeling at Dataflow Level, Behavioural Modeling, Switch Level Modeling, System Tasks, Functions and Compiler Directives, Sequential Circuit Description, Components Test and Verification.

TOTAL HOURS : 45

Text Book:

1. M. Morris Mano, "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2003

2. John .M Yarbrough, "Digital Logic Applications and Design", Thomson- Vikas publishing house, New Delhi, 2005.

3. Samir Palnitkar ,"A guide to Digital Design and Synthesis", 2nd Edition, Prentice Hall 2003

4. William Stallings,"Computer Organization and Architecture", 8th Edition, Pearson Education Asia, 2010.

REFERENCES

1. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill Publishing company limited, New Delhi, 2003.

2. Charles H. Roth, "Fundamentals of Logic Design", 2nd Edition, Thomson Publication Company, 2003.

3. Donald P. Leach and Albert Paul Malvino, "Digital Principles and Applications", 5th Edition , Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.

4. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 3rd Edition., New Delhi, 2003.

5. Thomas L. Floyd, "Digital Fundamentals", 8th Edition Pearson Education, Inc, New Delhi, 2003

OUTCOMES:

On completion of the course the students will be able to

- Describe concepts and terminology of digital electronics
- Formulate and employ a karnaugh map to reduce Boolean expressions.
- Analyze and design digital combinational circuits and sequential circuits
- Design digital circuits for various applications.
- Implement combinational logic circuits using reprogrammable logic devices.
- Develop HDL codes for various digital circuits.

ECB2213	ANALOG COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The purpose of this course is to introduce students to

- List various continuous wave modulation techniques.
- Differentiate all types of amplitude modulation systems based on transmission bandwidth, transmitted power and system complexity
- Apply the knowledge of vestigial side band modulation in television system.
- Compare amplitude modulation and angle modulation with respect to performance parameters.
- Analyze the noise performance of various analog receivers.
- Distinguish various pulse modulation techniques

MODULE I AMPLITUDE MODULATION 8

Introduction - Need for modulation, Principles of amplitude modulation. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop

MODULE II SSB AND VSB MODULATION 7

Single side-band modulation - Phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves. Vestigial side band modulation - Generation of VSB modulated wave, Envelop detection of VSB wave plus carrier, Frequency translation, Frequency division multiplexing, Application: Radio broadcasting, AM radio.

MODULE III TELEVISION ENGINEERING 8

Basics Television system and scanning principles, TV signal transmission and Propagation-Picture and sound signal Transmission-Modulation-VSBTransmission-Bandwidth-Transmitter-Signal Propagation-Interference –Monochrome TV receiver-Colour Receiver TV tuners-operation-Automatic Frequency Tuners(AFT),Automatic Gain Control in IF subsystems

MODULE IV ANGLE MODULATION 8

Angle modulation - Frequency modulation, transmission bandwidth of FM signals, frequency spectrum, phase modulation, relationship between FM&PM, narrow band FM & wide band FM. Generation of FM waves: direct method, indirect method of FM generation. Detection of FM waves: Balanced frequency discriminator, Zero crossing detector, Phase locked loop, Foster seely discriminator, ratio detector.

MODULE V NOISE THEORY 7

Sources of noise - shot noise, thermal noise, white noise, Noise bandwidth, Noise temperature, Noise figure - Measurement of noise figure, Signal in presence of noise, Narrow band noise. Noise in Continous wave modulation-Noise in SSB and DSB - SC

receiver, Noises in AM receiver threshold effect -noise in FM receivers capture effect - FM threshold effect -pre emphasis &de emphasis in FM

MODULE VI PULSE MODULATION AND DIGITAL TRANSMISSION 7

Sampling process and sampling theorem. Pulse modulation - Generation and detection of PAM, PWM and PPM, Pulse code modulation, delta modulation, adaptive delta modulation, differential pulse code modulation.

TOTAL HOURS : 45

Text Book:

1. Simon Haykin, "Communication System", 4th Edition, John Wiley & Sons, 1991.
2. Taub & Schilling, Gautam Sahe, "Principles of Communication Systems", 3rd Edition, TMH, 2008.
3. Wayne Tomasi, "Electronic Communication Systems: Fundamentals Through Advanced", 6th Edition, Pearson Education, 2007.
4. R.R. Gulati “Modern Television Practice: Principles, Technology and Servicing” 2nd edition, New Age International Publications

REFERENCES

1. Roddy and Coolen, "Communication Systems", 4th Edition, PHI learning, New Delhi, 2003.
2. George Kennedy and Bernard Davis, "Electronic Communication Systems", 4th Edition, Tata McGraw Hill, 2008.
3. K.N.Hari Bhat & Ganesh Rao, "Analog communications", 2nd Edition, Pearson Publication, 2008.
4. J.G. Proakis and M. Salehi, Communication Systems Engineering, 2nd Edition, Prentice Hall, 2002.
5. A.M.Dhake “TV and Video Engineering” Tata Mcgraw Hill,2001

OUTCOMES:

On completion of the course the students will be able to

- Explain continuous wave modulation techniques
- Differentiate and analyze the performance of AM, DSB-SC, SSB and VSB systems.
- Describe the basics of TV signal transmission andPropagation
- Compute the performance parameter for noise analysis in various analog receivers
- Design different types of pulse modulation system.
- Apply suitable analog/digital modulation techniques for data transmission.

ECB2214	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the characteristics and internal circuit of op-amps.
- To Characterize the differential amplifiers and current sources
- To design the various linear and non-linear applications of op-amps.
- To characterize the data converters and active filters.
- To explain the special purpose ICs like PLL,Timer IC, voltage regulators, switched capacitor filters.

MODULE I INTRODUCTION AND CIRCUIT CONFIGURATION OF LINEAR ICS **8**

Op Amp characteristics, Ideal versus Practical, Building Blocks of Op amp, Current sources, Current mirror, analysis of difference amplifier-Derivation of transfer characteristic, Analysis with active load, circuits for improving input impedance, level translator, output stage. Op Amp Specifications: input bias current, offset current, offset voltage, bandwidth, Gain Bandwidth product, frequency compensation and slew rate.

MODULE II LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS **7**

Linear circuits using operational amplifiers and their analysis: virtual ground, Inverting and non-inverting modes; adder, subtractor, difference amplifier; common mode rejection ratio (CMRR), Differentiator, Integrator, V to I converter and I to V converter, Instrumentation Amplifier, sine wave Oscillators, Log and Antilog amplifiers.

MODULE III NON LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS AND ANALOG MULTIPLIER **8**

Precision rectifier, Comparator, Application of comparator, Schmitt trigger, Multivibrators, Triangular wave generator. Analysis of four quadrant (Gilbert cell) and variable transconductance multiplier, DC analysis of Gilbert multiplier cell, Application of Gilbert cell as complete analog multiplier, modulator and phase detector.

MODULE IV DAC and ADC **8**

Analog switches, High speed Sample and Hold circuit. DAC techniques: Weighted Resistor, R-2R ladder, Inverted R-2R ladder, ADC techniques: Flash type, Counter type, Successive approximation, Single slope and Dual slope.DAC and ADC specifications - Linearity, accuracy, Monotonicity, Settling time and stability.

MODULE V TIMER AND ACTIVE FILTERS **6**

555 timer IC, Applications: Astable and Monostable operation, Active filters: First order, second order and higher order Low pass and high pass and band pass filter, Butterworth Filters.

MODULE VI PLL AND VOLTAGE REGULATORS 8

Voltage controlled Oscillator, PLL and Closed loop analysis of PLL, Applications of PLL: Frequency translation, AM, FM and FSK modulators and demodulators, Frequency synthesizers. Voltage regulator ICs: Linear and switched mode types, Switched capacitor filters, Frequency to voltage converter

TOTAL HOURS : 45

Text Book:

1. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 2nd Edition, New Age International Pvt. Ltd., 2003.
2. Gray and Meyer, 'Analysis and Design of Analog Integrated Circuits', 4th Edition, Wiley International, 2009.

REFERENCES

1. J.Michael Jacob, 'Applications and Design with Analog Integrated Circuits', 4th Edition, Prentice Hall of India, 1996.
2. Ramakant A. Gayakwad, 'OP-AMP and Linear IC's', 3rd Edition, Prentice Hall / Pearson Education, 1994.
3. Millman.J. and Halkias.C.C. 'Integrated Electronics', 2ndEdiiton,McGraw-Hill, 1972.
4. William D.Stanely, 'Operational Amplifiers with Linear Integrated Circuits'.4th Edition, Pearson Education, 2004.
5. Sedra& Smith, "Micro Electronic Circuits", 5th Edition, Oxford University Press, 2004.
6. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata McGraw-Hill , 2002.

OUTCOMES:

On completion of the course the students will be able to

- Determine the difference between ideal and practical AC & DC characteristics of an opamp.
- Design and develop linear and non-linear applications of operational amplifiers.
- Design of electronic circuits using linear integrated circuits
- Design waveform generators and data converters.
- Design electronic circuit using IC 555 and IC 723 for various mathematical operations, and Industrial applications.
- Apply the concepts in the design of electronic circuits using linear integrated circuits and their applications into the processing of analog signals.

LSB2181	BIOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aim of the course is to introduce basic biological concepts to the engineering students to promote cross-breeding of ideas. In particular,

- To provide an overview of cell structure and function.
- To give basic idea on biochemistry related to biological aspects.
- To introduce genes, their structure, inheritance and about living organisms.
- To give an understanding on metabolism, respiration, etc.
- To inform students of engineering about the interface of biology and engineering.

MODULE I BASICS OF CELL STRUCTURE AND FUNCTION 7

Cells as unit of life – basic chemistry of cell – cell structure and functions – Prokaryotic and Eukaryotic cells, cell wall, plasma membrane, endoplasmic reticulum, nucleus, chromosomes- cell division – mitosis, meiosis.

MODULE II BIOCHEMISTRY 8

Biomolecules – introduction – pH and biological buffers – carbohydrates-mono, di, oligo and polysaccharides, lipids- phospholipids, glycolipids, sphingolipids, cholesterol, steroids, prostaglanin – proteins – types – glycoproteins, lipoproteins – structures - primary, secondary, tertiary and quarternary – Nucleic acids – RNA – Types – tRNA, mRNA, giRNA, miRNA, DNA – rDNA, gDNA, cDNA.

MODULE III GENETICS 7

Genes – structure and functions – behavior, dominance and epigenetics, evolution – inheritance – reproduction and gene distribution – genome of living organisms – plants – bacteria and viruses – animals – humans, genetic engineering and cloning.

MODULE IV MICROBIOLOGY 8

Microbiology – basis of microbial existence – microbial diversity – classification and nomenclature of micro-organisms- impact of microorganisms in industry, agriculture and health, industrial microbiology – primary and secondary screening of micro-organisms, fermentation processes, bioreactors, microbial ecology – microbial bio-remediation – epidemiology and public health.

MODULE V METABOLISM 7

Metabolic processes – bio-membranes, diffusion, absorption, osmo-regulation, photosynthesis, respiration, digestion and excretion.

MODULE VI BIOLOGY AND ENGINEERS 8

Application of biology in engineering– living things as the solutions (bionics)– living things as models (biometrics) – bio-technology – biomedical engineering– effect of human action

on living things – right balance – bioinformatics – bionanotechnology – sensors, biosensors, biochips-ethics in biology.

TOTAL HOURS : 45

REFERENCES

1. Johnson, Arthur T., “Biology for Engineers”, CRC Press, FL, 2011.
2. Campbell and Recee, “Biology”, Pearson, Benjamin Cummins Pub. 8th edition, 2008.
3. Scott Freeman, “Biological Sciences”, Prentice Hall, 2002.

OUTCOMES:

After finishing this course students will be able to

- understand basics of biological processes, composition of cell contents
- understand applications of microbes in industrial manufacturing of proteins, antibodies and antibiotics.
- understand cloning and genetic engineering
- identify the genes in different genome (plants, microbes, animals, human) and compare the genes by bioinformatics approaches

ENB2282	CONFIDENCE BUILDING AND BEHAVIORAL SKILL	L	T	P	C
	COMMON TO ALL B.Tech. PROGRAMMES	0	0	2	1

OBJECTIVES:

To enable the students to develop communication skills for verbal communication in the work place.

TOPICS OUTLINE

This course is practical oriented one and exercises will be given to the students group users /individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member and coordinated by the overall course coordinator.

LAB ACTIVITIES

- Introduction: Soft skills definition, examples
- Verbal communication: Case study, communication and discussion
- Prepared speech
- Impromptu speech
- Debate: Case studies - Attitude and Behavior: role play and exploration
- Ability to ask for help - communication and team work
- Manners and etiquette
- Organization and Planning
- Time keeping
- Conduct in workplace
- Conscientiousness
- Work output
- Professionalism
- Motivation
- Ownership of tasks
- Adaptability/flexibility

ASSESSMENT

The assessment will be continuous and portfolio based. The students must produce the record of the work done through the course of the semester in the individual classes. The portfolio may consist of a) the individual task outline and activities, b) worked out activities c) Pre-designed sheets which may be provided by the Faculty member. The portfolio will be used by the Faculty member for assessment. The course coordinator in consultation with the course committee shall decide at the beginning of the semester, the number of exercises, method of assessment of each and the weightage for the end semester assessment.

OUTCOMES:

The students should be able to:

- Develop verbal communication skills
- Debate with other students confidently
- Communicate effectively their ideas

ECB2215	DIGITAL ELECTRONICS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

The purpose of this course is to introduce students to

- To design and implement the Combinational circuits.
- To verify the functionalities of Flipflops.
- To design and implement sequential circuits.
- To simulate the Verilog programs using simulators

LIST OF EXPERIMENTS

1. Design and implementation of Adders and Subtractor using logic gates.
2. Design and implementation of code converters using logic gates.
3. Design and implementation of 4 bit binary Adder/ subtractor and BCD adder using IC 7483.
4. Design and implementation of 2-Bit Magnitude Comparator using logic gates & 8 Bit magnitude Comparator using IC 7485.
5. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
6. Design and implementation of Multiplexer and De-multiplexer using logic gates.
7. Design and implementation of encoder and decoder using logic gates.
8. Study of SR,JK, D, T Flip Flops.
9. Design and implementation of asynchronous and synchronous counters.
10. Design and Implementation of shift registers using Flip- flops.
11. Simulation of combinational and sequential circuits using verilog HDL.
12. Mini project

OUTCOMES:

On completion of this course the student will be able to:

- Apply Knowledge of number systems, codes and Boolean algebra to the analysis and design of digital logic circuits
- Develop the capability to analyze and design simple combinational circuits containing logic gates, multiplexer, encoder and decoder
- Develop the capability to analyze and design simple sequential circuits containing latch circuit and flip-flop circuits
- Identify, formulate and solve engineering problems in the area of digital logic circuit design to meet desired needs within realistic constraints.

- Use the techniques, skills and modern engineering tools such as logic works and Verilog HDL, necessary for engineering practice
- To function on multi-disciplinary teams through digital circuit experiments and projects

ECB2216	ELECTRONICS CIRCUITS II LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

The purpose of this course is to introduce students to

- To design and verify the characteristics and operation of feedback amplifier and oscillator circuits.
- Simulation of feedback amplifier and oscillator circuits using PSPICE software

LIST OF EXPERIMENTS

1. Design and Analysis of Feedback Amplifiers
2. Design and Verification of Oscillators
3. Design of Class C Single Tuned Amplifier
4. Design of Collector Coupled AstableMultivibrator
5. Design of Collector Coupled MonostableMultivibrator
6. Design of Fixed Bias BistableMultivibrator
7. Design of UJT Relaxation Oscillator
8. Characteristics of OpAmp.
9. Inverting and Non-Inverting Amplifiers and Voltage follower
10. Adder, Subtractor, Difference amplifier, Integrator, Differentiator
11. Instrumentation Amplifier
12. Active 2nd Order Butterworth Filters
13. Design of Multivibrators and Schmitt Trigger using opAmp
14. Design of Multivibrators using 555 timer.
15. Simulation using PSpice, Netlist of above experiments

OUTCOMES:

On completion of this course the student will be able to:

- Analyze the stability of feedback amplifiers and their steady state performance by designing various feedback amplifiers.
- Estimate the DC and AC Analysis of operational amplifiers.
- Design and implement circuits using Op amp to perform various mathematical operations.
- Design and demonstrate the sinusoidal and non-sinusoidal oscillators using BJT and Op-AMP
- Develop and analyze various multivibrator circuits using BJT and OP amp
- Evaluate the performance of electronic circuits using PSPICE simulation tool

ECB2217	COMMUNICATION ENGINEERING LAB I	L	T	P	C
		0	0	3	1

OBJECTIVES:

The purpose of this course is to introduce students to

- To implement AM and FM modulation and demodulation
- To analyse the effects of sampling
- To implement various pulse modulation techniques
- To simulate various modulation & demodulation using simulator tools
- To develop an application using various modulation techniques.

LIST OF EXPERIMENTS

Design and test the performance of

1. AM modulator and demodulator.
2. FM modulator and demodulator
3. Sampling Theorem verification
4. PAM modulator and demodulator.
5. PPM modulator and demodulator.
6. PWM modulator and demodulator.
7. PCM and Demodulator
8. Delta modulator and demodulator
9. Spectral analysis of AM/FM.
10. Mini project based on above experiments

OUTCOMES:

On completion of this course the student will be able to:

- Apply Knowledge of the angle, phase and pulse modulation techniques to the analysis and design of signal communication circuits.
- Analyze and design simple angle, phase modulators using diode, transistors and integrated circuits
- Analyze and design Sampler circuits, pulse modulators using diode, transistors and integrated circuits
- Identify, formulate and Perform spectral estimation in the area of communication engineering to meet desired needs within realistic constraints.
- Apply the techniques, skills and modern engineering tools such as PSpice, multisim, ELVIS necessary for engineering practice.
- Justify and incorporate the modulator and demodulator circuits for various applications.

SEMESTER V

ECB3101	**DIGITAL SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

- Study of discrete Fourier transform and its applications in digital Filter design.
- Familiarize on design of FIR and IIR Digital filters.
- To understand the concept of quantization noise and its effects in multi-rate signal processing.
- To introduce signal processing concepts in systems having more than one sampling frequency.
- To study the architecture and features of various digital signal processors

MODULE I DISCRETE FOURIER TRANSFORM 8

Introduction to Discrete Fourier Transform, Direct computation of DFT, Properties of DFT, Efficient computation of DFT- FFT algorithms - Radix-2FFT algorithms -Decimation in Time, Decimation in Frequency algorithms, Computing Inverse DFT.

MODULE II DESIGN AND IMPLEMENTATION OF IIR FILTERS 8

Design of Low Pass Butterworth filters, analog to analog transformation - Analog to digital transformation, Bilinear transformation - prewarping, Impulse invariant transformation.

MODULE III DESIGN AND IMPLEMENTATION OF FIR FILTERS 8

Amplitude and phase responses of FIR filters - symmetric and anti-symmetric impulse response, group delay and phase delay, Frequency response of FIR filters, Linear phase filters - Windowing techniques for design of Linear phase FIR filters - Rectangular, Hamming, Hanning and Blackmann windows, Frequency sampling techniques.

MODULE IV FINITE WORD LENGTH EFFECTS 8

Representation of numbers, - Fixed point and binary floating point number representation - comparison, errors due to truncation and rounding- off, Quantization noise - derivation for quantization noise power at the input and output of a digital filter, Co-efficient quantization error -product quantization error, Round-off effects in digital filters, Limit cycle oscillation - Over flow error-Signal scaling.

MODULE V MULTIRATE DIGITAL SIGNAL PROCESSING 8

Mathematical description of change of sampling rate - Interpolation and Decimation , Decimation by an integer factor, Interpolation by an integer factor, Sampling rate conversion by a rational factor, Time and frequency domain descriptions - Single, Multi stage, Polyphase structures - Quadrature Mirror Filter banks - Sub-band Coding, few applications using sub-band coding.

MODULE VI DIGITAL SIGNAL PROCESSORS 5

Introduction to DSP architecture - Harvard and Von Neumann architecture - Pipelining - Dedicated MAC unit - Advanced addressing modes, Architecture of TMS320C5X and C54X, Overview of instruction set of TMS320C5X and C54X.

L:45, T:15

TOTAL HOURS : 60

Text Book:

1. John G Proakis, Dimtris G Manolakis, "Digital Signal Processing Principles, Algorithms and Application", 4th Edition, PHI, 2009.
2. B.Venkataramani, M. Bhaskar, "Digital Signal Processor Architecture, Programming and Application", 2nd Edition, TMH 2002.

REFERENCES

1. Alan V Oppenheim, Ronald W Schafer, John R Back, "Discrete Time Signal Processing", 2nd Edition, PHI, 2000.
2. Avtar Singh, S.Srinivasan, "DSP Implementation using DSP microprocessor with Examples from TMS32C54XX", 3rd Edition,Thomson / Brooks cole Publishers, 2003.
3. Johny R.Johnson, "Introduction to Digital Signal Processing", 2nd Edition, Prentice Hall, 2002.
4. S.K.Mitra, "Digital Signal Processing- A Computer based approach", 4th Edition, Tata McGraw-Hill, New Delhi, 2011.

OUTCOMES:

On completion of this course the student will be

- Represent discrete-time signals in the frequency domain, using z-transform and discrete Fourier transform (DFT).
- Analyze the basic forms of FIR and IIR filters and, to design filters with desired frequency responses.
- Analyze the effect of finite word length in the DSP systems.
- Implement the multirate processing fundamentals using decimation and interpolation.
- Illustrate the basic architecture of digital signal processors.
- Apply digital signal processing concepts in audio, video signals etc.

ECB3102	DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an overview of the design of digital communication systems.
- To introduce the basic concepts of digital modulation of baseband and passband signals.
- To give an exposure to information theory, source coding and error control coding.
- To discuss about the spread spectrum modulation schemes.

MODULE I SAMPLING PROCESS AND WAVEFORM CODING TECHNIQUES 9

Sampling theorem, Signal reconstruction in time domain, impulse and flat top sampling, interpolation formula, signal space interpretation, Sampling of Bandpass Signal. Pulse Code Modulation, Differential pulse code modulation, Delta modulation, Idling noise and slope overload, Adaptive delta modulation, DPCM, Comparison of PCM and DM.

MODULE II BASEBAND SIGNALING 7

Baseband data formats & their properties - Matched filter - ISI and Nyquist's criterion for distortionless transmission - Correlative coding - M-ary schemes-Eye-pattern, Equalization, Adaptive Equalization - Bit Synchronization.

MODULE III BAND PASS SIGNALING 8

Geometric Representation of signals - Generation, detection, PSD and BER of Coherent BPSK, BFSK, and QPSK - Principles of CPFSK (MSK, GMSK), and QAM - Carrier synchronization- Structure of Non-Coherent Receivers - Principle of DPSK.

MODULE IV INFORMATION THEORY 7

Entropy - Discrete memory less channels - Mutual information - Channel capacity - Channel transition matrices - Channel capacity for continuous channels -Hartley-Shannon law - Source coding theorem - Huffman and Shannon-Fano codes.

MODULE V ERROR CONTROL CODING 7

Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes-Convolution codes - Viterbi Decoder - Trellis Coded Modulation.

MODULE VI SPREAD SPECTRUM TECHNIQUES 7

Spread Spectrum Codes - PN sequence - Auto correlation and Cross correlation properties - M Sequences - Direct Sequence Spread Spectrum - Code synchronization, Processing Gain - Jamming Resistance - CDMA - Frequency Hop Spread Spectrum.

TOTAL HOURS : 45

Text Book:

1. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons 2001.
2. Simon Haykin, "Digital Communications", 2nd Edition, John Wiley & Sons 2005.

REFERENCES

1. Leon W. Couch, "Modern Communication Systems: Principles and Applications", 2nd Edition, Prentice Hall.1995
2. John G. Proakis, "Digital Communication", 4th Edition, McGraw Hill Higher Education, 2000.
3. Bernard Sklar, "Digital Communications: Fundamentals and Applications", 2nd Edition, Prentice Hall, 2001.
4. B. P. Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press,1998.
5. Roger L. Peterson, David E. Borth and Rodger E. Ziemer, "Introduction to Spread Spectrum Communications", 1st Edition, Prentice Hall Inc, 1995.

OUTCOMES:

On completion of this course the student will be able to

- Explain the fundamental concepts of sampling and quantization.
- Distinguish between baseband and pass band digital communication systems.
- Choose different modulation techniques based on the application.
- Apply the suitable source coding and channel coding techniques.
- Develop secure communication using spread spectrum techniques
- Design and evaluate a digital communication system on need basis

ECB3103	MICROPROCESSORS & MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To illustrate the architecture of 8085 and 8086 microprocessors.
- To introduce the programming and interfacing techniques of 8086 microprocessor.
- To analyse the basic concepts and programming of 8051 microcontroller
- To develop the interfacing circuits for various applications of 8051 microcontroller.
- To introduce the architecture of advanced microprocessors and microcontrollers.

MODULE I ARCHITECTURE OF 8085 AND 8086 MICROPROCESSORS 9

Introduction to Micro Computers, 8085 Microprocessor Architecture, 8086 Microprocessor - Architecture- Register Organization -Memory Organization-Minimum Mode bus cycle-Maximum Mode bus cycle-Timing Diagram-Interrupts & Service Routine.

MODULE II PROGRAMMING OF 8086 5

Addressing modes - Instruction set- Assembly language Programming.

MODULE III INTERFACING WITH 8086 9

Memory interfacing.Interfacing with peripheral ICs like 8251-serial I/O,8255-parallel I/O, 8254-programmable interval timer, 8279-Keyboard display controller, 8257-DMA, LEDs, LCDs, ADCs and DACs.

MODULE IV 8051 MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.

MODULE V INTERFACING 8051 MICROCONTROLLER 9

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

MODULE VI ADVANCED MICROPROCESSORS & MICROCONTROLLERS 4

Advanced Microprocessor Architecture - Pentium; Concept of CISC and RISC processors; Introduction to ARM processor and PIC microcontroller.

TOTAL HOURS : 45

Text Book:

1. Ramesh S Gaonkar, "Microprocessor Architecture, Programming and application with 8085", 4th Edition, Penram International Publishing, New Delhi, 2000.
2. A.K. Ray and K.M.Burchandi, "Intel Microprocessors Architecture Programming and Interfacing", 2nd Edition, McGraw Hill International Edition, 2000.

3. Mohammed Ali Mazidi and Janice GillispieMazidi, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education Asia, New Delhi, 2003.

REFERENCES

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
2. Kenneth J Ayala, "The 8051 Microcontroller Architecture Programming and Application", 2nd Edition, Penram International Publishers (India), New Delhi, 1996.
3. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH,2012.
4. M. Rafi Quazzaman, "Microprocessors Theory and Applications: Intel and Motorola", Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Describe the architecture of 8085, 8051 and 8086.
- Illustrate the organisation of registers and memory in microprocessors and microcontroller.
- Identify the addressing mode and calculate the number of T-states required for the execution of an instruction.
- Develop assembly language programs suitable for real time applications using microprocessors / microcontroller.
- Explain the different interfacing devices.
- Outline the architecture of ARM processor and PIC microcontroller.

ECB3104	TRANSMISSION LINES AND ANTENNAS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To familiarize with propagation of signals through transmission lines and waveguides.
- To analyze the characteristics of transmission lines and waveguides..
- To demonstrate the theory of wire antennas and aperture antennas
- To familiarize with array antennas.
- To study in detail various modes of radio propagation.

MODULE I BASICS OF ELECTROMAGNETIC WAVES 7

Review of Maxwell's Equation, Boundary conditions, Solution for Free-Space conditions, Uniform Plane Waves, Polarization, Reflections by a perfect conductor. Poynting theorem.

MODULE II TRANSMISSION LINE ANALYSIS 8

Lumped and distributed element models of transmission lines, characteristic impedance, terminated transmission line - reflection coefficient, wavelength and velocities of propagation, Transfer Impedance, Standing waves, Impedance matching, Smith Chart - impedance and admittance chart, scattering matrix.

MODULE III WAVEGUIDES 7

Planar waveguides, TE and TM waves - characteristics, velocities of propagation, Rectangular waveguides - dominant mode, cut-off wavelength, phase velocity, group velocity, characteristic impedances, Circular waveguides - Solution in cylindrical coordinates.

MODULE IV FUNDAMENTALS OF ANTENNAS 8

Vector Potential, Radiation from a infinitesimal alternating current element, Half-wave dipole antenna - power radiated, Mono-pole antenna. Antenna Parameters, radiation resistance, radiation intensity, radiation pattern, directivity, gain, effective height and effective aperture. Reciprocity theorem, Self and Mutual impedance.

MODULE V ANTENNA ARRAYS AND APERTURE ANTENNAS 8

Linear Arrays - Broadside and End-fire arrays, pattern multiplication, parasitic array elements, log-periodic and Yagi-Uda antenna. Loop antenna, Travelling wave antenna concepts. Horn Antennas and its types – Reflector antennas and its types.

MODULE VI RADIO WAVE PROPAGATION 7

The three basic types of propagation; ground wave, space wave and sky wave propagation. Wave tilt of surface wave, Tropospheric wave, Structure of atmosphere, ionospheric propagation, virtual height, critical frequency, MUF, space wave propagation, ground wave propagation, forward scatter propagation.

TOTAL HOURS :60

Text Book:

1. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice Hall Int., 2009.
2. John D Ryder, "Networks, Lines and Fields", 2nd Edition, Prentice Hall India, 1994.
3. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas and Wave Propagation", 3rd Edition, Tata McGraw Hill, 2006.

REFERENCES

1. Constantine A. Ballanis , "Antenna Theory ", 2nd Edition, John Wiley & Sons, 2003.
2. R. S. Elliot, "Antenna Theory and Design", Revised edition, Wiley-IEEE Press., 2003.
3. David M.Pozar, "Microwave Engineering", 4th Edition, John Wiley, 2013.

OUTCOMES:

On completion of this course the student will able to

- Explain the basic concepts of Transmission lines and antennas.
- Illustrate the types of wave propagation.
- Describe the theories of various transmission medium, antenna and radio wave propagation.
- Analyze various types of transmission mediums and antenna based on the applications.
- Analyze the characteristics of different transmission mediums, antenna and antenna arrays.
- Design various types of antennas for a given application.

MSB3181	MANAGEMENT OF BUSINESS ORGANIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an exposure to principles of management and organizational structures.
- To introduce concepts of operation and material management.
- To provide an understanding of management of human resources.
- To impart some basic knowledge on marketing, pricing and selling.
- To give an overview of accounting and management of finance.

MODULE I PRINCIPLES OF MANAGEMENT 7

Functions of management - Planning - Organizing - Staffing - Direction - Motivation - Communication - Coordination - Control, organizational structures - Line - Line and staff - Matrix type, functional relationships - Span of control, Management by Objectives (MBO) - Forms of Industrial ownership.

MODULE II OPERATIONS MANAGEMENT 8

Introduction to operations management - Functions of production/operations management - Types of production, Overview of facility location - Lay out planning, introduction to production planning and control, work study, quality assurance, lean manufacturing and six sigma, plant maintenance and management.

MODULE III MATERIALS MANAGEMENT 8

Materials Planning - Types of inventory, Purchasing function - Source selection - Negotiation - Ordering, Stores management - Functions - Types of stores - Overview of inventory control, Introduction to newer concepts: MRP-I – MRPII -ERP - JIT.

MODULE IV HUMAN RESOURCE MANAGEMENT 7

Human Resource Management - Objectives - Role of Human Resource Manager - Manpower planning - Selection and placement - Training – Motivation - Performance assessment - Introduction to grievances handling and labour welfare.

MODULE V MARKETING MANAGEMENT 7

Marketing - Concept and definition - Elements of marketing mix - PLC – Steps in new product development - Pricing objectives and methods – Advertising types/media - Steps in personal selling - Sales promotion methods – Distribution channels: functions, types.

MODULE VI FINANCIAL MANAGEMENT 8

Financial management functions - Introduction to financial accounts, financial performance - Profit and loss account statement - Balance sheet, budgetary control - Meaning - Uses - limitations - Types of costs - Basics of depreciation methods -Break-even analysis - Meaning - Assumption - Uses and limitations, working capital - Meaning and relevance - Use of operating ratios.

TOTAL HOURS : 45

REFERENCES

1. Bhushan Y.K., "Fundamentals of Business Organisation and Management", Sultan Chand & Co., 2003.
2. Banga & Sharma "Industrial Engineering & Management", 11th Edition, Khanna Publications, 2007.
3. Khanna, O.P., "Industrial Engineering & Management", Dhanpat Rai Publications, 2004.
4. S.N.Maheswari "Principles of Management Accounting", 16th Edition, S.Chand & Company Ltd, 2007.

OUTCOMES:

After doing the course,

- Students would have gained basic knowledge of the concepts of management and the functions of management.
- Students would have learnt fundamentals of the functional areas of management viz., operations management, materials management, marketing management, human resources management and financial management.

ENB3181	CAREER BUILDING & PEOPLE SKILLS	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To prepare the students for building their competencies and career building skills.

COURSE OUTLINE:

This course is practical oriented one and exercises will be given to the students group users /individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member and coordinated by the overall course coordinator.

LAB ACTIVITIES:

- Preparation for the placement
- Group discussions: Do's and Don'ts - handling of Group discussions - What evaluators look for.
- Interview - awareness of facing questions - Do's and Don'ts of personal interview.
- Selection of appropriate field vis-à-vis personality / interest.
- Preparation of Resume-OBJECTIVES:s, profiles vis-à-vis companies requirement.
- Enabling students to prepare for different procedures / levels to enter into any company - books / websites to help for further preparation.
- Technical interview - how to prepare and face it.
- Workplace skills
- Presentation skills
- Oral presentations
- Technical presentations
- Business presentations
- Technical writing
- Interpersonal relationships - with colleagues - clients - understanding one's own behavior - perception by others.

ASSESSMENT:

As the course is practical one, it will be assessed using a portfolio based assessment. The students must in consultation with the Faculty member, plan a portfolio of evidence for the above mentioned activities. The students must develop a résumé or résumés that promote own ability to meet specific job requirements and plan their portfolio in a format appropriate to industry they wish to target. The case studies will contain direct observation of the

candidate developing career plans, résumés and skills portfolio, reflect written or oral questioning to assess knowledge and problem-solving activities to assess ability to align career aspirations with realistic career goals. The course coordinator in consultation with the course committee will decide the number of exercises and mark to be awarded for each beside the weightage for the end semester assessment.

OUTCOMES:

The course will help the students to

- Develop team work skills.
- Take part effectively in various selection procedures followed by the recruiters.

ECB3105	DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To develop DSP design and analysis techniques.
- To implement Linear and Circular Convolution.
- To implement FIR and IIR filters
- To analyze the architecture of DSP processor.
- To introduce programming for DSP applications.

LIST OF EXPERIMENTS:

EXPERIMENTS USING MATLAB

1. Generation of Standard discrete time signal.
2. Generating a complex valued signal.
3. Generating even and odd composition of signal.
4. Step and impulse response of LTI systems.
5. Frequency response of LTI systems.
6. Discrete Fourier transform -Direct Computation & Using FFT.
7. Linear convolution.
8. Circular convolution.
9. Design of IIR filters -Butterworth using impulse invariance method.
10. Design of IIR filters - Chebyshev using bilinear transformation.
11. Design of FIR filters using windowing.
12. Sampling and Reconstruction.
13. Sampling rate conversion-interpolation & decimation.

EXPERIMENTS USING DSP PROCESSORS:

14. Linear convolution
15. Circular convolution
16. Discrete Fourier transform
17. Inverse Discrete Fourier transform.

MINI PROJECT

Based on the ideas of the above mentioned experiments, students have to do mini project

OUTCOMES:

On completion of this course the students will be able to

- Use DSP tools such as MATLAB to analyze discrete time signals and systems
- Analyze the properties of discrete time signals and systems and identify its implication for practical systems.
- Evaluate and plot the frequency, magnitude and phase response of linear time-invariant systems using MATLAB.
- Evaluate the discrete Fourier transform (DFT) of a sequence, use the FFT to compute DFT and implement using DSP processor.
- Implement convolution using DSP processor.
- Design digital IIR and FIR filter.

ECB3106	COMMUNICATION ENGINEERING LAB- II	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To design and construct analog and digital transmitters and receivers.
- To analyze receiver performance and channel behavior.
- To generate PN sequence with its characteristics.
- To simulate error control coding and source coding using MATLAB.

LIST OF EXPERIMENTS:

1. Sampling and reconstruction

Design and test the performance of

2. ASK modulator and Demodulator
3. PSK modulator and Demodulator
4. FSK modulator and demodulator
5. QPSK modulator and demodulator
6. QAM modulator and demodulator
7. Generation of PN sequence and studying its characteristics.
8. Line coding and decoding.

SIMULATION EXPERIMENTS :

9. Direct Sequence Spread Spectrum &frequency hop Techniques.
10. Analyze the performance of data transmission system using Eye pattern
11. Source coding technique
12. Error controlling technique
13. Mini project

OUTCOMES:

On completion of this course the student will be able to

- Apply sampling and reconstruction techniques in digital communication
- Analyse different digital modulation and demodulation techniques using hardware and validate the results using simulators
- Implement source coding and decoding techniques
- Analyse spread spectrum communication techniques using simulation tools.
- Analyse the performance of data transmission system
- Estimate the performance of communication through AWGN and Rayleigh channel

ECB3107	MICROPROCESSOR AND MICROCONTROLLER LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To introduce the concept of Assembly Language Programming (ALP).
- To develop student's skills in assembly language programming to interface 8086 with various modules.
- To familiarize students on programming and interfacing of 8051 Microcontroller.

LIST OF EXPERIMENTS:

PART – I 8086 Microprocessor basic programs

1. 16 bit Arithmetic operation
2. Searching in an array
3. Sorting of an array
4 String operations

PART – II 8086 Microprocessor interfacing programs

5. Stepper motor interface
6. Generate an interrupt using 8253 timer.
7. Program to display a string of characters using Keyboard display (8279).
8. Interfacing PPI (8255).

PART – III 8051 Microcontroller basic and interfacing programs

9. 16 bit Arithmetic operation
10. Interfacing DAC and ADC
11. Communication between 8051 kit and PC using USART (8251)
12. Interfacing Traffic Light control

OUTCOMES:

On completion of the course, the students will be able to

- Develop the assembly language program for the basic arithmetic and logical operations of 8086 Microprocessor and 8051 Microcontroller.
- Design circuit for interfacing different peripheral devices with Microprocessor/Microcontroller.
- Analyze the errors during the execution of program.
- Develop real time applications using Microprocessor/Microcontroller based systems.
- Develop communication between Microcontroller and PC.
- Design and develop programs for various applications using Microprocessor/Microcontroller.

SEMESTER VI

GEB3201	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore the salient features and processes that characterise the rocks, soils, water and their interconnectivity with the atmosphere through bioelement cycling
- To rationalise the biological environment at the level of cell, the population, the community ,ecosystem and the biome
- To get sensitized with the impacts of human activity on the natural environment and with the methods to conserve it
- To study the impacts of human activity on water and air and to identify the steps to conserve
- To find out an unique solution for the environmental crisis in the developing and developed countries
- To learn about the assessments of the impacts with the help of NGOs and public and to proceed to a sustainable living.

MODULE I PHYSICAL ENVIRONMENT 8

Earth's surface - the Interior of Earth – Plate Tectonics – Composition of the Crust: Rocks – formation and types, Soils – formation and components – soil profile.

Atmosphere – structure and composition – weather and climate – tropospheric airflow

Hydrosphere – water budget – hydrological cycle – Rainwater and precipitation, River Water and solids, Lake Water and stratification, Seawater and solids, soil moisture and groundwater.

Bioelement cycling – The Oxygen cycles – the carbon cycle – the nitrogen cycle – the phosphorous cycle – the sulfur cycle sodium, potassium and magnesium cycles.

MODULE II BIOLOGICAL ENVIRONMENT 7

Cellular basis of life – prokaryotes and eukaryotes – cell respiration – photosynthesis – DNA and RNA – genetically modified life

Population dynamics – population – population growth – survival and growth curves – population regulation – future of human population

Biological communities - Five major interactions: competition, predation, parasitism, mutualism and commensalism – Concepts of habitat and niche – natural selection – species richness and species diversity – ecological succession and climax.

Ecosystem and Biomes – Food Chains and food webs – biomagnifications – ecological pyramids - Trophic levels – Energy flow in ecosystem – ecosystem stability – Terrestrial and aquatic biomes.

MODULE III IMPACTS ON NATURAL RESOURCES AND CONSERVATION

Biological resources – nature and importance – direct damage – introduced species – Habitat degradation, loss and fragmentation – Values of biodiversity – hotspots of biodiversity, threats to biodiversity- endangered and endemic species of India- conservation of biodiversity, in-situ and ex-situ conservation

Land Utilization – past patterns of land use – Urban and Industrial development – deforestation, salinisation, soil erosion, and desertification – Modern Agriculture and Impacts

Waste management – types of solid wastes: domestic, municipal, industrial and e-wastes - disposal options – reduce, recovery, reuse – waste minimization, cleaner production technology.

MODULE IV IMPACTS ON WATER AND AIR AND CONSERVATION 8

Water pollution – organic oxygen demanding wastes – anthropogenic phosphate and eutrophication - Ground water contamination – Usage of fertilizer and pesticides– acid rain –acid mine discharges – toxic metals – organochlorines – endocrine disrupting substances-treatment process – Rain water harvesting and watershed management- manmade radionuclide's – thermal pollution

Atmospheric pollution – primary and secondary pollutants – anthropogenic, xenobiotic, synergism, sources and sink, residence time, levels and impacts of major pollutants – processes leading to smog, acid rain, global warming, stratospheric ozone depletion - Noise pollution and abatement.

MODULE V IMPACTS ON ENERGY AND CONSERVATION, ENVIRONMENTAL CRISIS 8

Energy – Renewable and non renewable energy resources – thermal power plants – nuclear fuels, fossil fuels, solar energy, wind energy, wave energy, tidal energy, ocean thermal energy, hydropower, geothermal energy, biomass energy

Environment crisis – state of environment in developed and developing countries- managing environmental challenges for future – disaster management, floods, earthquake, cyclone and landslides.

MODULE VI ENVIRONMENTAL IMPACT ASSESSMENT AND SUSTAINABILITY 5

Environmental Impact Assessment – Impacts: magnitude and significance – steps in EIA – methods – precautionary principle and polluter pays principle – role of NGOs and Public – value education –Environment protection act (air, water, wild life) and forest Conservation act

Concept of Sustainability – Sustainable Development – Gaia Hypothesis - Traditional Knowledge for sustainability.

TOTAL HOURS : 45

Text Book:

1. Environmental Science (The Natural Environment and Human Impact), Andrew R. W. Jackson and Julie M. Jackson, Pearson Education Limited, Harlow, Essex, England, 2000.
2. Environmental Science (Working with the Earth), G Tyler Miller, Jr., Thomson Brooks/Cole, 2006.

REFERENCES

1. Physical Geology, Earth Revealed, David McGeary and Charles C Plummer, WCB McGraw Hill, 1998.
2. Sustainability: A Philosophy of Adaptive Ecosystem Management, Bryan G. Norton, 2005.
3. Environmental Impact Assessment, Larry W. Canter, McGraw-Hill, 1996.
4. The Revenge of Gaia: Why the Earth is Fighting Back and How We Can Still Save Humanity, James Lovelock, Penguin UK, 2007.

OUTCOMES:

After the completion of the course the student should be able

- To differentiate the rock and the soil and to recognise the pivotal importance of bioelement cycling
- To examine the biological environment both at the microscopic and biome levels
- To analyse the role played by the urban and industrial development that change the pattern of land use
- To judge the level of air and water pollution
- To discriminate renewable energy from non renewable energy and to discuss about the environmental crisis prevailing
- To assess the human impacts on environment and to appreciate the sustainable living

ECB3211	RF & MICROWAVE ENGINEERING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To analyze RF and microwave networks containing passive distributed components.
- To introduce various passive microwave components and to study their characteristics.
- To make measurement of various high frequency parameters.
- To study about the various microwave devices and their principle of operation
- To study about planar transmission lines and microwave integrated circuits.

MODULE I TWO PORT RF NETWORKS- CIRCUIT REPRESENTATION 7

Low frequency parameters - impedance, admittance, hybrid and ABCD. High frequency parameters – Formulation of S parameters – properties of S parameters-Reciprocal and lossless networks – Introduction to component basics -wire, resistor, capacitor and inductor – applications of RF.

MODULE II TRANSISTOR AMPLIFIER AND MATCHING NETWORKS 7

Amplifier power relation – stability considerations –gain considerations –noise figure, impedance matching networks –frequency response –T and πmatching networks-microstripline matching networks.

MODULE III MICROWAVE PASSIVE COMPONENTS AND MEASUREMENTS 9

Microwave junctions- Tee junctions- Magic Tee – Rat race-Corners- bends and twists-Directional couplers- Two hole directional couplers-Isolator-Circulator–S Matrix for microwave components. VSWR measurement - power measurement- Impedance measurement- Insertion loss and attenuation measurements-measurement of scattering parameters- Measurement of dielectric constant of a solid using waveguide.

MODULE IV MICROWAVE SEMICONDUCTOR DEVICES 7

Transferred Electron Devices: Introduction- Gunn-Effect Diodes-GaAs Diode, Ridley-Watkins-Hilsum(RWH) Theory, Modes of Operation, LSA Diodes, InP Diodes, CdTe Diodes, Microwave Generation and Amplification. Avalanche Transit-Time Devices: Introduction, Read Diode, IMPATT Diodes, TRAPATT Diodes.

MODULE V MICROWAVE TUBES 8

Microwave tubes-High frequency limitations- Principle of operation of Two cavity klystron, Multicavity Klystron, Reflex Klystron, Traveling Wave Tube & Magnetron.

MODULE VI STRIPLINES & MMICs 7

Introduction to Microstrip Lines - Characteristic Impedance, Attenuation Losses - Parallel Strip Lines - Distributed Lines - Coplanar Strip Lines - Shielded Strip Lines. Monolithic Microwave Integrated Circuits: Introduction - Materials: Substrate Materials, Conductor Materials, Dielectric Materials, Resistive Materials - Monolithic Microwave Integrated-Circuit Growth - MMIC Fabrication Techniques.

TOTAL HOURS : 60

Text Book:

1. Samuel Y Liao,“Microwave Devices & Circuits”, Prentice Hall of India, 2006.
2. Reinhold. Ludwig and Pavel Bretshko “RFCircuit Design”, Pearson Education, Inc., 2006

REFERENCES

1. Robert.E.Collin-Foundations of Microwave Engg–McGraw Hill, 2002.
2. Annapurna Das and Sisir K.Das,“Microwave Engineering”,Tata Inc., 2004.
3. M.M.Radmanesh, RF & Microwave Electronics Illustrated, Pearson Education, 2007.
4. Robert E.Colin, 2nd Edition “Foundations for Microwave Engineering”, McGraw Hill, 2001.
5. D.M.Pozar, “Microwave Engineering”, John Wiley & sons,Inc., 2006.

OUTCOMES:

On completing this course, Students will be able to,

- Select a microwave source, device and striplines for a particular application.
- Determine the network parameters and S-Matrix of various passive devices.
- Estimate fundamental microwave measurements.
- Analyze the various microwave devices and components
- Solve the problems related to RF Amplifiers, Impedance matching Circuits, Microwave devices and Oscillators.
- Illustrate the basic concepts of RF and Microwave Engineering and fabrication technologies of MIC.

ECB3212	VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the technology, design concepts, electrical properties and modeling of Very Large Scale Integrated circuits.
- To introduce the fundamental principles of MOS and CMOS process technology and to examine the basic building blocks of large-scale digital integrated circuits.
- To offer a profound understanding of the design of complex digital VLSI circuits.
- To bring both Circuits and System views on design together.
- To learn basic NMOS, CMOS & BiCMOS circuits.
- To introduce the concepts of modeling a digital system using Hardware Description Language.

MODULE I MOS TRANSISTOR THEORY 8

MOS transistor, threshold voltage equation, body effect, MOS device design equation, sub threshold region, Channel length modulation. mobility variation, Tunnelling, punch through, hot electron effect MOS models, small signal AC Characteristics, CMOS inverter, ßn / ßp ratio, noise margin, static load MOS inverters, differential inverter, tristate inverter, BiCMOS inverter.

MODULE II CMOS PROCESS TECHNOLOGY 7

Semiconductor Technology overview, basic CMOS technology, Current CMOS enhancement, Circuit elements – resistor – capacitor – interconnects - sheet resistance & standard unit capacitance concepts delay unit time, inverter delays, driving capacitive loads, propagate delays, MOS mask layer, stick diagram, design rules and layouts, symbolic diagram, scaling of MOS circuits, Lambda Based Design rules, scaling factor

MODULE III BASICS OF DIGITAL CMOS DESIGN 8

Combinational MOS Logic circuits- CMOS logic circuits with a MOS load, complex logic circuits, Transmission Gate. Sequential MOS logic Circuits - Behaviour of hi stable elements, S-R latch Circuit, clocked latch and Flip Flop Circuits, CMOS D latch and triggered Flip Flop. Dynamic Logic Circuits - principles of pass transistor circuits, Dynamic CMOS circuit techniques

MODULE IV DYNAMIC CMOS AND CLOCKING 8

Introduction, advantages of CMOS over NMOS, CMOS\SOS technology, CMOS\bulk technology, latch up in bulk CMOS., static CMOS design, Domino CMOS structure and design, Charge sharing, Clocking- clock generation, clock distribution, clocked storage elements.

MODULE V DESIGNING ARITHEMETIC BUILDING BLOCKS 7

Introduction, advantages of CMOS over NMOS, CMOS\SOS technology, CMOS\bulk technology, latch up in bulk CMOS., static CMOS design, Domino CMOS structure and design, Charge sharing, Clocking- clock generation, clock distribution, clocked storage elements.

MODULE VI DESIGN & SIMULATION USING VERILOG HDL 7

Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural, gate level, switch level modeling, Design hierarchies, Behavioral and RTL modeling, Test benches, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop, counters, shift registers.

TOTAL HOURS :45

Text Book:

1. Uyemura J.P: Introduction to VLSI circuits and systems, Wiley 2002.
2. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000.
3. Douglas A Pucknell & Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)
4. Sung Mo Kang & Yosuf, Lederabic Law, “CMOS Digital Integrated Circuits: Analysis and Design”, McGraw-Hill (Third Edition)
5. J.Bhasker: Verilog HDL primer, BS publication, 2001.

OUTCOMES:

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

- Analyze the characterization of MOS and CMOS circuits.
- Analyze the resistance and capacitance effects of transistors and interconnects to further calculate transistor delay.
- Design combinational and sequential digital logic circuits.
- Design clocking schemes to avoid clock skewing.
- Design data path and arithmetic circuits for processor design
- Write program using verilog HDL for VLSI digital systems.

ECB3213	OPTICAL COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply the principle and techniques of fiber optical communication.
- To distinguish various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
- To integrate optical source, optical detectors, Network Topologies and their application in optical Communication system.

MODULE I INTRODUCTION TO OPTICAL FIBERS 7

Evolution of fiber Optic system - Element of an Optical Fiber Transmission link - Ray Optics - Optical Fiber Modes and Configurations - Mode theory of Circular Wave guides - Overview of Modes - Linearly Polarized Modes – Single Mode and Multimode mode Fibers - Graded Index fiber structure.

MODULE II SIGNAL DEGRADATION IN OPTICAL FIBERS 8

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides - Information Capacity determination - Group Delay - Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers - Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers - Mode Coupling - Design Optimization of SM fibers.

MODULE III FIBER OPTICAL SOURCES 8

Direct and indirect Band gap materials - Light source materials - LED structures, Quantum efficiency and LED power, Modulation of a LED, Laser Diodes - Modes and Threshold condition - Rate equations - External Quantum efficiency, Resonant frequencies - Laser Diodes structures and radiation patterns – Single Mode lasers - Modulation of Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers

MODULE IV FIBER OPTICAL RECEIVERS 7

PIN and APD diodes - Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise - Comparison of Photo detectors – Fundamental Receiver Operation - Pre-amplifiers - Error Sources - Receiver Configuration - Probability of Error - The Quantum Limit.

MODULE V DIGITAL TRANMISSION SYSTEM 7

Point-to-Point links - System considerations - Fiber Splicing and connectors - Link Power budget - Rise-time budget - Noise Effects on System Performance - Line coding-Error correction.

MODULE VI OPTICAL NETWORKS 8

Introduction to optical networking components-Basic networks-Network Topologies, Performance of passive linear Buses, Performance of star Architectures- Operational Principles of WDM, Erbium-doped fiber, Solitons, Basic concepts of SONET/SDH-Optical CDMA- Measurements- optical power meter- optical time domain reflectometer (OTDR).

TOTAL HOURS : 45

Text Book:

1. Gerd Keiser, "Optical Fiber Communication", 3rd Edition, McGraw-Hill International, Singapore, 2000.

2. J. Gowar, "Optical Communication System", Prentice Hall of India, 2001.

REFERENCES

1. J. Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3rd Edition, 2008.

2. D. C. Agrawal , "Fiber Optic Communication", S.Chand& Co Ltd., 2005.

3. Rajiv Ramaswami and Kumar Sivarajan, "Optical Networks: A practical perspective", 2nd Edition, Morgan Kaufmann, 2001.

OUTCOMES:

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

- Describe the basic elements in optical communication system
- Identify and analyze the characteristics of optical fibers
- Quantify, and understand the significance of dispersion and attenuation in optical fiber communications.
- Classify the Optical sources and detectors
- Design real time fiber optic systems based on link power and rise time budget
- Analyze the optical network based on network topologies and WDM

ECB3214	VLSI LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn coding of combinational and sequential circuits using Verilog HDL
- To familiarize the simulation and synthesis tools for FPGAs.
- To implement the design of logic circuits in FPGAs.
- To estimate power and delay of logic circuits in FPGAs.

LIST OF EXPERIMENTS:

FPGA BASED EXPERIMENTS:

1. Study of Simulation tools.
2. Study of Synthesis tools.
3. Study of development tool for FPGAs for schematic entry and HDL.
4. Design, simulation and synthesis of basic logic gates, combinational circuits using HDL.
5. Design, simulation and synthesis of adders to add / subtract two 8 bits numbers.
6. Design, simulation and synthesis of multipliers.
7. Design, simulation and synthesis of Shift registers and Counters.
8. Verification of on board LEDs and switches of FPGA using HDL codes.
9. Design of traffic light controller using HDL and above tools.
10. Design of Real time Clock (2 digits, 7 segment LED displays each for Hour, Minute and Sec) and verification in the FPGA board.

IC BASED EXPERIMENTS:

1. Layout generation, parasitic extraction and post layout simulation of the circuit designed in exp 4,5,6, and 7.
2. Power estimation and delay estimation of the circuit designed in exp 4,5,6,7.

OUTCOMES:

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

- Write Verilog code for combinational circuits and sequential circuits
- Simulate the combinational circuits and sequential circuits using Xilinx ISE and Quartus Altera
- Synthesize the designed digital circuits using Spartan FPGA kits.
- Implement the designed circuits in FPGA and verify the operation physically
- Estimate the power and delay of the digital circuit from device utilization summary
- Develop a real time application using Xilinx ISE and FPGA kit

ECB3215	MICROWAVE AND OPTICAL COMMUNICATION LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To study the characteristics of various microwave and optical sources.
- To determine S - matrices of various passive microwave components.
- To find the gain and radiation pattern of various microwave antennas.
- To measure various microwave parameters using network analyzer.

LIST OF EXPERIMENTS:

1. Characteristics of Gunn diode Oscillator.
2. Characteristics of Reflex Klystron.
3. Microwave Power Measurement.
4. Characteristics of Directional Coupler and Magic Tee.
5. Determine of guide wavelength, frequency measurement.
6. VSWR measurements.
7. Determination of impedance of microwave components.
8. Radiation Patten of Horns, parabolic antenna.
9. Measurement of Dielectric constants.
10. Simulation of Microwave components.
11. Characteristics of microwave components using Network Analyser.
12. Measurement of Numerical aperture of optical fiber.
13. Measurement of losses in optical fiber.
14. Digital Transmission through fiber optic link.
15. Characteristics of LED.
16. Characteristics of LASER Diode.
17. Characteristics of APD
18. Characteristics of Photo Diode
19. Measurement of Link Characteristics using OTDR

OUTCOMES:

On completion of the course the students will be able to

- Apply the theoretical principles underlying microwave devices and network.
- Use the techniques, skills and modern engineering toolssuch as network analyzer and HFSS, for solving problems in microwave systems

- Design a microwave system, components or process to meet desired needs within realistic constraints.
- Develop the capability to analyze the characteristics of optical sources and detectors.
- Classify the structures of Optical fiber and types
- Interpret and estimate the various losses in the optical fibers

SEMESTER VII

ECB4101	CELLULAR MOBILE COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of mobile communication
- To discuss the various propagation methods, modulation techniques and equalization techniques.
- To describe the coding and multiple access techniques used in the mobile communication
- To explain various wireless network systems and standards.

MODULE I CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTAL 8

Cellular Concept: Frequency reuse, channel assignment, hand-off, Interference and system capacity, trunking and grade of service, Improving coverage and capacity in Cellular systems.

MODULE II MOBILE RADIO PROPAGATION 9

Free space propagation model, Two ray model , Knife edge diffraction model, path loss models,Outdoor and Indoor propagation models, Impulse model, Small scale Multipath measurements, parameters of Mobile multipath channels.

MODULE III MODULATION TECHNIQUES 6

Modulation Techniques: BPSK, DPSK-p/4 QPSK – OQPSK, Minimum Shift Keying, Gaussian MSK, M-ary FSK, Orthogonal Frequency Division Multiplexing.

MODULE IV EQUALIZATION 7

Equalization: Survey of Equalization Techniques, Linear Equalization, Non-linear Equalization, Diversity Techniques, RAKE receiver.

MODULE V CODING AND MULTIPLE ACCESS TECHNIQUES 7

Coding- Vocoders, Linear Predictive Coders, GSM Codec, Multiple Access Techniques- FDMA, TDMA, CDMA, SDMA.

MODULE VI WIRELESS SYSTEMS AND STANDARDS 8

Second Generation, Third Generation and Fourth generation Wireless Networks and Standards - AMPS, GSM, IS-95, LTE.

TOTAL HOURS : 45

Text Book:

1. T.S.Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.

REFERENCES

1. R. Blake, "Wireless Communication Technology", Thomson Delmar, 2003.
2. W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications", 2nd Edition, McGraw-Hill International, 1998.
3. Feher K. "Wireless Digital Communications", Pearson education.,1995.
4. Schiller, "Mobile Communication", Pearson Education Asia Ltd., 2000.
5. ChristopherCox, “An Introduction to LTE: LTE,LTE – Advanced SAE and 4G Mobile Communications” 2nd Edition, John Wiley and sons, Inc, 2012.

OUTCOMES:

On completion of this course the students will be able to

- Describe and apply the fundamental concepts of Mobile Communication.
- Determine the necessary parameters involved in radio propagation.
- Explain the propagation methods and various modulation techniques.
- Illustrate the types of equalization and diversity techniques.
- Apply different types of coding and Multiple Access techniques.
- Identify various Wireless systems and standards.

ECB4102	EMEBDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded systems
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To learn entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED COMPUTING PLATFORM 7

Embedded computing - characteristics and challenges - embedded system design process- - Overview of Processors and hardware units in an embedded system.

MODULE II COMPUTING PLATFORM AND DESIGN ANALYSIS 9

CPU buses - Memory devices - I/O devices - Component interfacing - Design with microprocessors - Development and Debugging - Program design - Model of programs - Assembly and Linking - Basic compilation techniques - Analysis and optimization of execution time, power, energy, program size - Program validation and testing.

MODULE III REAL TIME OPERATING SYSTEMS (RTOS) 7

Overview of Operating Systems (OS) concepts - Real time systems - Types-Need for RTOS in Embedded Systems -Compare OS and RTOS - RTOS Tasks - Task States - Multitasking -Context Switching - Scheduling Algorithms-IPC mechanisms.

MODULE IV DISTRIBUTED EMBEDDED SYSTEMS 8

Communication buses - Shared memory communication - accelerated design-networks for embedded systems - networks based design - Internet enabled systems.

MODULE V EMBEDDED SOFTWARE DEVELOPMENT TOOLS 7

Host and target machines - Linkers / Locators for Embedded Software - Debugging techniques - Instruction set simulators Laboratory tools - Practical example - Source code.

MODULE VI SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEMS 7

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - C' Program compilers - Cross compiler - Optimization of memory codes.

TOTAL HOURS : 45

Text Book:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

REFERENCES

1. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003.
2. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint, Tata McGraw-Hill, 2003.
3. Steve Heath, "Embedded System Design", 2nd Edition, Elsevier, 2004.
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

OUTCOMES:

On completion of this course the student will be able to

- Describe the software and hardware components in embedded system.
- Apply code optimization and debugging techniques for host and target based embedded system
- Compare the features, characteristics and challenges in OS and RTOS.
- Illustrate shared memory communication in distributed embedded system.
- Design real time embedded application.
- Explain the assembly and high level languages program for embedded applications.

ECB4103	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the concepts of data communication and networks.
- To discuss on ISO-OSI model and different protocols.
- To distinguish different protocols of network layer, transport layer and application layer.
- To describe gigabit Ethernet in computer networks.

MODULE I DATA COMMUNICATIONS 7

Components - Components and Categories - types of Connections - Topologies-Protocols and Standards - ISO / OSI model -Modems - RS232 Interfacing sequences.

MODULE II DATA LINK LAYER 10

Error - detection and correction - Parity - LRC - CRC - Hamming code - Flow Control and Error control: stop and wait - go back N ARQ - selective repeat ARQ- sliding window techniques LAN: Ethernet IEEE 802.3, IEEE 802.4, and IEEE 802.5

MODULE III NETWORK LAYER 8

Packet Switching and Datagram approach - IP addressing methods - Sub netting - Routing - Distance Vector Routing - Link State Routing - Routers.

MODULE IV TRANSPORT LAYER 7

Duties of transport layer - Multiplexing - Demultiplexing - Sockets - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Congestion Control - Quality of services (QOS).

MODULE V APPLICATION LAYER 7

Domain Name Space (DNS)-SMTP, FDP, HTTP, WWW-Security -Cryptography.

MODULE VI MODULE VI PRACTICAL PERSPECTIVE OF COMPUTER NETWORKS GIGABIT ETHERNET 6

Network Services, Network Service Primitives - Gigabit Ethernet reference model, Media access control sublayer group, LLC/MAC Service Primitives, Physical sublayer group.

TOTAL HOURS : 45

Text Book:

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.
2. David G. Cunningham & William G. Lane, "Gigabit Ethernet Networking", Macmillan Technology Series, Macmillan Technical Publishing,1999.

REFERENCES

1. James .F. Kurouse& W. Rouse, "Computer Networking: A Topdown Approach Featuring", 2nd Edition, Pearson Education, 2004.
2. LarryL.Peterson& Peter S. Davie, "Computer Networks", 3rd Edition, Harcourt Asia Pvt. Ltd., 2007.
3. Andrew S. Tanenbaum, "Computer Networks", 4th Edition, PHI, 2003.
4. William Stallings, "Data and Computer Communication", 6th Edition, Pearson Education, 2000.

OUTCOMES:

On completion of this course the students will be able to

- Explain the importance of computer networks and the basic components of a network.
- Illustrate the concept of OSI model, local area networks, their topologies and its applications.
- Implement the error detection and correction techniques in computer networks
- Analyze IEEE standards and protocols of various layers of OSI model.
- Compute IP address and subnet masks to fulfill networking requirements.
- Compare the operation and features of application layer protocol and use of cryptography & network security.

ECB4104	MINI PROJECT - DESIGN & IMPLEMENTATION	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To design, implement and test various electronic circuits like regulated power supply, Transmitter, Timer, MODEMs, Microprocessor & DSP based systems leading to the implementation of a Mini project.

OUTCOMES:

On completion of this course the students will be able to

- Develop electronics circuits like regulated power supply and timer.
- Design AM and FM Transmitter.
- Design Microprocessor & DSP based systems.
- Develop the capability to analyze various electronic circuits.
- Synthesize and develop the real time applications using various electronic circuits.
- Synthesize and develop the real time applications using Microprocessor & DSP based systems

ECB4105	NETWORK LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To analyze the communication networks characteristics.
- To analyze various MAC and Routing layer Protocols.

LIST OF EXPERIMENTS:

1. Simulation study of ALOHA protocol.
2. Simulation study of CSMA & CSMA - CD protocol.
3. Simulation Study of Token Bus and Token Ring Protocol.
4. Simulation study of Stop-and-Wait protocol.
5. Simulation study of Sliding window protocol - Go back N.
6. Simulation study of Routing protocols. (Distance Vector Routing Protocol, Link State Routing Protocol)
7. Serial communication between 2 personal computers using RS-232.
8. Shared and switched bandwidth utilization in LANs using Hub and switches.
9. WLAN realization and throughput measurement.
10. Mini Project

OUTCOMES:

On completion of this course the students will be able to

- Analyze the characteristics of different MAC protocols
- Apply MAC protocols for various scenarios for packet communication between nodes.
- Estimate the number of successfully transmitted packet by a node
- Analyze the performance of MAC protocol and calculate the Bit Error Rate & Throughput
- Implement various routing protocol and identify the optimized path between source and destination through simulation
- Develop the program for interfacing computers using RS-232 standard

ECB4106	EMBEDDED SYSTEMS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn the concepts of programming on software tools for Microcontrollers
- To develop a program, simulate and test 8051 and PIC Microcontrollers
- To Interface serial ports and displays with Microcontrollers
- To familiarize a real time operating system.

LIST OF EXPERIMENTS:

1. Design with 8051/PIC Microcontrollers -Data flash with erase, verify, fusing through ATMEL and INTEL tools -Simple application programs with kit and through assembler.
2. I/O Programming, Timers - with 8051/ PIC Microcontrollers - Assembly and C Programming.
3. Program for seven segments LED Interface - Character based LCD Interface.
4. Interrupts, Serial port programming with 8051/ PIC Microcontrollers - Assembly and C Programming.
5. Program for Analog to Digital conversion (with on chip ADC).
6. Program to rotate the stepper motor in clockwise and anticlockwise direction.
7. Interfacing external memory with processor
8. Implementation of Real Time Clock with I2C.
9. Study one type of Real Time Operating Systems.

OUTCOMES:

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

- Develop simple application programs through Keilμvision.
- Design Interface for I/O ports, timers , serial ports with 8051/ PIC Microcontrollers
- Demonstrate seven segment LED and LCD interfacing with processor.
- Employ Assembly and C Programming to verify the stepper motor and real time clock interface.
- Develop a real time embedded application using 8051and PIC Microcontrollers.
- Appraise a real time operating system.

PROFESSIONAL ELECTIVES

RF COMMUNICATION

		L	T	P	C
ECBX01	**RF SYSTEM DESIGN**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To make them familiarize with the RF components.
- To give outline about the importance of RF circuit design.
- To experiment with design techniques of filters, amplifiers and Oscillators.
- To analyze impedance Matching and biasing network for various circuits.
- To design RF amplifiers, oscillators and mixers.

MODULE I RF ISSUES 6

Importance of RF design, Electromagnetic Spectrum. Scattering and chain scattering matrices, Generalized scattering matrix, Analysis of two port networks, Smith Chart and applications.

MODULE II RF FILTER DESIGN 8

Overview, Basic resonator and filter configuration, Special filter realizations, Filter implementations, Coupled filter.

MODULE III ACTIVE RF COMPONENTS & APPLICATIONS 9

RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks, Impedance matching using discrete components, Microstripline matching networks.

MODULE IV RF AMPLIFIER DESIGN 9

Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, Broadband, high power and multistage amplifiers.

MODULE V RF OSCILLATOR DESIGN 7

One port and two port negative resistance oscillators. Oscillator configurations, Oscillator design using large signal measurements.

MODULE VI MIXERS & APPLICATIONS 6

Basic characteristics of Mixers; Phase Locked Loops ; RF directional couplers and hybrid couplers ; Detector and demodulator circuits.

TOTAL HOURS : 45

Text Book:

1. Reinhold Ludwig and Powel Bretchko, "RF Circuit Design - Theory and Applications", 1st Edition, Pearson Education Asia, 2001.
2. Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", 2nd Edition, Pearson Education Asia, 2002.
3. David. M. Pozar, "Microwave Engineering", 3rd Edition, John Wiley and Sons, 2005.

REFERENCES

1. S.Y.Liao, "Microwave Amplifiers and Oscillators Design", Prentice Hall, New Jersey, 1999.
2. David.M.Pozar, "Microwave Engineering" 3rd Edition, John Wiley and Sons, 2005.
3. Roland E. Best, "Phase - Locked Loops: Design, simulation and applications", 5th Edition, McGraw Hill Publishers, 2003.
4. G.Gonzalez, "Microwave Transistors and Amplifiers: Analysis and Design", Prentice Hall, New Jersey 1999.
5. E.da Silva, Butterworth Heinmann,"High Frequency and Microwave Engineering", Oxford Publications, 2001.

OUTCOMES:

On completion of this course the student will be able to

- Recall the Importance of RF design.
- Classify the RF circuits and its applications.
- Develop various Filter configurations for different circuits.
- Analyze impedance Matching and biasing network for various circuits.
- Select appropriate matching circuit for low noise circuits.
- Design of amplifiers ,oscillators and mixers

ECBX02	ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply, identify and understand the basic knowledge of science in EMI & EMC in different environments.
- To select and apply appropriate coupling principles for EMI.
- To formulate and analyze different EMI measurements
- To understand the concepts of EMI control mechanisms which meets the specific needs with appropriate techniques.
- To select, apply and differentiate appropriate standards for EMI/EMC.
- To design, analyze and understand the process of creating EMC PCBs

MODULE I EMI ENVIRONMENT 8

Concepts of EMI and EMC and definitions - Sources of EMI - Celestial Electromagnetic noise - Lightning discharge-Electrostatic Discharge-Electromagnetic Pulse - Electromagnetic emissions - Noise from relays and Switches - Nonlinearities in Circuits.

MODULE II EMI COUPLING PRINCIPLES 8

Capacitive coupling - Inductive coupling- Common impedance ground coupling-Ground loop coupling-Transients in power supply lines- Radiation coupling, Conduction coupling-Common - mode and Differential mode interferences-Conducted EM noise on power supply lines.

MODULE III EMI MEASUREMENTS 7

Open area test site measurements-Measurement precautions - Open -area test site-Anechoic Chamber-TEM Reverberating TEM-GTEM cell - Comparisons.

MODULE IV EMI CONTROL TECHNIQUES 7

EMC Technology- Grounding-Shielding-Electrical Bonding-Power line filter-CM filter - DM filter- EMI suppression Cables- EMC Connectors -Isolation transformer.

MODULE V EMI / EMC STANDARDS 7

Introduction- Standards for EMI/EMC- MIL-STD-461/462-IEEE/ANSI standard-CISPR/IEC standard- FCC regulations-British standards-VDE standards-Euro norms-Performance standards-some comparisons.

MODULE VI EMC DESIGN OF PCBS 8

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

TOTAL HOURS : 45

REFERENCES

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.
2. Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, New York,1988.
3. C.R.Paul, "Introduction to Electromagnetic Compatibility", John Wiley and Sons, Inc, 1992
4. Bernhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Edition, Artech house, 1986.

OUTCOMES:

On completion of this course the students will be able to

- Outline the basic knowledge of science in EMI & EMC in different environments.
- Distinguish coupling principles for EMI.
- Measure different EMI parameters
- Apply EMI control mechanisms for specific needs with appropriate techniques.
- Compare and discuss different standards for EMI/EMC.
- Design and analyze the process of creating EMC PCBs

ECBX03	TELECOMMUNICATION SWITCHING NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of speech digitization and digital switching.
- To describe the network synchronization, control and management.
- To explain the statistical modeling of telephone traffic, blocking system characteristics and queuing system characteristics.
- To discuss about various digital networks.

MODULE I SPEECH DIGITIZATION AND TRANSMISSION 7

Quantization Noise, Companding, Differential Coding, Vocodors, Pulse Transmission, Line Coding, TDM.

MODULE II DIGITAL SWITCHING 8

Switching Functions, Space Division Switching, Time Division Switching -Time Division space switching, Time Division Time Switching, Time multiplexed space switching, Time multiplexed Time Switching, Combination Switching Crossbar switching- Principle of common control, Touch tone dial telephone.

MODULE III NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT 8

Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, Network Control, Network Management.

MODULE IV TELECOMMUNICATION TRAFFIC 7

Introduction, unit of traffic, Congestion traffic measurement, A mathematical model, Lost call systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times, Finite Queues.

MODULE V TELEPHONE NETWORKS AND SIGNALING 7

Introduction, Subscriber loops systems, Switching hierarchy, Routing, Transmission plan, Transmission system, Numbering plans, Signaling techniques, Inchannel signaling, Common channel signaling, Cellular mobile telephony.

MODULE VI DIGITAL NETWORKS 8

Data Networks: Data transmission in PSTNs, Switching Techniques for data transmission, Data communication architecture, ISDN: Network and protocol architecture, Transmission channels, User Network interface, Signaling, Numbering & Addressing, ISDN standards, Broadband ISDN

TOTAL HOURS : 45

Text Book:

1. Bellamy John, "Digital Telephony", 3rd Edition, John Wiley & Sons Inc., 2000.
2. Viswanathan. T., "Telecommunication Switching System and Networks", Prentice Hall of India Ltd., 1994.

REFERENCES

1. Flood J E, "Telecommunications Switching, Traffic and Networks" 1st Indian reprint, Pearson education Asia, 2001.

OUTCOMES:

On completion of this course the student will be able to

- Describe the working principle of digital modulation involved in telecommunication switching
- Discuss the principles of digital switching in evaluating the performance of telecommunication networks
- Solve problems and design simple systems related to telecommunications networks.
- Compare and analyze Line coding techniques and examine its error performance.
- Classify communication switches and describe the essence of the key protocols that are used with switched networks
- Justify the reasons for switching, and the relative merits of the possible switching modes.

ECBX04	WIRELESS NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the concepts of wireless communication.
- To apply various wireless applications like WLAN and WAN.
- To discuss wireless internet and adhoc networks.
- To describe the recent advances in wireless networks.

MODULE I INTRODUCTION TO WIRELESS COMMUNICATION 7

Fundamentals of Wireless Communication Technology, Electromagnetic Spectrum, Radio Propagation Mechanisms, Characteristics of Wireless Channel, Multiple Access Techniques, Coding Techniques for Wireless Communication.

MODULE II WIRELESS LAN 7

Historical overviews of the LAN industry, evolution of the WLAN industry, wireless home networking, IEEE 802.11. The PHY Layer, MAC Layer, wireless ATM.

MODULE III WIRELESS WANS AND MANS 9

Cellular concepts, , cell fundamentals signal to interference ratio calculation, Channel Allocation Algorithms, Handoffs, capacity expansion techniques - cell splitting, use of directional antennas for cell sectoring, micro cell method, overlaid cells, Global System for mobile communication, Data over voice channel, CDMA 2000, GPRS and higher data rates, short messaging service in GPRS

MODULE IV WIRELESS INTERNET 7

Address Mobility, Mobile IP, Route Optimization TCP in Wireless Domain - Traditional TCP, TCP over wireless, Snoop TCP, Indirect TCP, Mobile TCP, Transaction Oriented TCP, Wireless Application Protocol (WAP), WAP Protocol Stack.

MODULE V ADHOC WIRELESS NETWORKS 9

Introduction to Adhoc Networks, Issues in Adhoc Networks- Medium Access Scheme, Routing, Multicasting, Transport Layer Protocols, Pricing Scheme, QoS provisioning, Self Organization, Security, Energy management, Scalability, Deployment Considerations, MAC protocols, Sensor Network Architecture.

MODULE VI RECENT ADVANCES IN WIRELESS NETWORKS 6

Ultra wide Band Radio (UWB) Communication Operation and Issues of UWB, Wireless Fidelity Systems, Service provider Models for WiFi systems, Interoperability of WiFi systems, Optical Wireless Networks.

TOTAL HOURS : 45

REFERENCES

1. Kaveh Pahlavan, Prashant Krishnamoorthy, "Principles of Wireless Networks,-A unified approach", PHI, New Delhi, 2009.
2. C.Siva Ram Murthy, B S Manoj, "Ad hoc Wireless Networks, Architectures and Protocols", Pearson, 2004.
3. Jochen Schiller, "Mobile Communications", 2nd Edition, Person Education, 2003.
4. X.Wang and H.V.Poor, "Wireless Communication Systems", Pearson education, 2004.
5. M.Mallick, "Mobile and Wireless design essentials", Wiley Publishing Inc. 2003.
6. Nicopolitidis, M.S.Obaidat, G.I. Papadimitria, A.S. Pomportsis, "Wireless Networks", John Wiley & Sons, 2003.

OUTCOMES:

On completion of this course the students will be able to

- Describe the basic concepts of wireless communication.
- Describe working principle of wireless LAN network and protocol involved in physical layer and MAC layer.
- Apply the concepts of cell fundamentals and channel allocation techniques in cellular communication.
- Explain the importance of various TCP and WAP protocol.
- Illustrate the mechanism of Ad Hoc Networks.
- Classify various wireless networks.

ECBX05	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To define satellite orbits and to understand about satellite communication.
- To illustrate geostationary orbit and to formulate link power budget equations.
- To explain the basic concepts of earth and space segments
- To analyze, classify and compare different satellite accesses techniques
- To introduce the principles and mechanism involved in satellite networks and channels.
- To illustrate the facts and ideas of different satellite services and its applications.

MODULE I SATELLITE ORBITS 8

Satellite Orbit - Kepler's Laws. Orbital elements and terms for Earth orbiting satellites. Orbital Perturbations. Calendars & Dates – Sidereal time- Coordinate Systems.

MODULE II GEOSTATIONARY ORBIT & SPACE LINK 8

Definition of Geostationary orbit. Antenna Look Angles. Polar Mount Antenna. Limits of Visibility. Earth Eclipse of Satellite. Radio wave Propagation effects – Polarization. EIRP. Link Power Budget equation. System Noise. Carrier-to-Noise Ratio for uplink and downlink.

MODULE III EARTH SEGMENT & SPACE SEGMENT 7

Spacecraft subsystem – Power supply subsystem, AOCS, TT&C Subsystem, Transponders, Antenna subsystem.

Earth segment – Receive only Home TV Systems, Transmit-Receive Earth stations.

MODULE IV SATELLITE ACCESS 7

FDMA: Single Access. Pre assigned & Demand-Assigned FDMA. Bandwidth-limited a Power-limited TWT amplifier operation.

TDMA: Frame and Burst formats, carrier recovery. Pre assigned & Demand-Assigned TDMA. On-board signal Processing for FDMA/TDMA operation. Satellite switched TDMA.

CDMA: Direct-Sequence spread spectrum. Acquisition and trickling. CDMA throughput.

MODULE V SATELLITES IN NETWORKS 8

Asynchronous Transfer Mode: ATM Layers, ATM Switching, ATM over satellite. Enhancing TCP over satellite channel. Split-TCP connections. Asymmetric Channels.

MODULE VI SATELLITE SERVICES 7

Direct Broadcast Services: Transponder capacity, Home receiver indoor & outdoor units. Satellite Mobile services. VSATs. Remote Sensing. Satellite Navigation

TOTAL HOURS : 45

Text Book:

1. Dennis Roddy, "Satellite Communications", 4th Edition, McGraw-Hill Publication, 2006.

REFERENCES

1. Timothy Pratt, Charles Bostian, Jeremy Allmuti, "Satellite Communications", John Wiley &Sons (Asia) Pvt. Ltd. 2004.
2. Wilbur L. Pritchard, Henri G.Suyder, Hond Robert A.Nelson, "Satellite Communication Systems Engineering", 2nd Edition, Pearson Education Ltd., 2003.
3. M.Richharia,"Satellite Communication Systems (Design Principles)", 2nd Edition, Macmillan Press Ltd, 2003.

OUTCOMES:

On completion of the course students will be able to

- Describe satellite orbits and understand about calendars and coordinate systems
- Describe geostationary orbit and can analyze uplink and downlink equations.
- Compare the concepts of earth and space segments
- Distinguish satellite accesses techniques
- Describe the mechanism involved in satellite networks and channels.
- Summarize services of different satellites

ECBX06	MULTIMEDIA COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the components of Multimedia Communication.
- To describe the different compression techniques for text, image, audio and video signals.
- To familiarize VoIP technology.

MODULE I MULTIMEDIA COMPONENTS 4

Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.

MODULE II TEXT COMPRESSION 9

Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy encoding -source encoding-Huffman coding-Adaptive Huffman coding - arithmetic coding - Shannon-Fano coding - LZW algorithms.

MODULE III IMAGE COMPRESSION 8

DPCM-Adaptive PCM -adaptive predictive coding-linear Predictive coding-code excited LPC - Transform coding - DCT - JPEG.

MODULE IV AUDIO COMPRESSION 8

Audio compression - A law and μ law companding - Basic sub-band coding - Application to speech coding - G.722.

MODULE V VIDEO COMPRESSION 8

Video compression principles - H.261 - H.263 - MPEG 1, 2, 4.DVI technology-Packet Video.

MODULE VI VOIP TECHNOLOGY 8

Basics of IP transport, VoIP challenges, Protocols, Call establishment and release, VoIP and SS7, Quality of Service- CODEC Methods-VOIP applicability

TOTAL HOURS : 45

Text Book:

1. K.R. Rao, Z S Bojkovic, D A Milovanovic, "Multimedia Communication System", Standards, and Networks", Pearson Education, 2007.
2. Khalid Sayood, "Introduction to Data Compression", Morgan Kauffman Harcourt India, 2nd Edition, 2000.
3. Yun Q. Shi, Huifang Sun, "Image and video compression for Multimedia Engineering", CRC Press,1999.
4. Marcus goncalves "Voice over IP Networks", McGraw Hill, 1998.

REFERENCES

1. Fred Halshall "Multimedia communication - applications, networks, protocols and standards", Pearson education, 2007
2. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education,2002.
3. Ranjan Parekh, "Principles of Multimedia", TMH 2006.

OUTCOMES:

On Completion of this course, the students will be able to

- Distinguish and describe the various components of multimedia communication.
- Describe various compression techniques and apply them for text compression.
- Explain various compression techniques and apply them for image compression.
- Describe various compression techniques and apply them for sound compression.
- Describe various compression techniques and apply them for video compression.
- Apply VOIP technology.

ECBX07	ADVANCED MICROWAVE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To analyze transmission-line circuits and periodic structures at RF, microwave frequencies
- To describe the operation and analyze the performance of basic waveguide systems
- To design various Microwave filters and amplifiers
- To assess qualitatively and quantitatively the role of microwave components in the areas of microwaves and optics

MODULE I FIELD ANALYSIS OF TRANSMISSION LINES 9

Microstrip Transmission lines-Low Frequency Solutions-Microstrip Attenuation-High Frequency Properties of Microstrip Lines. Coupled Microstrip Lines. Strip transmission. Coupled Strip Lines. Coplanar Transmission lines.

MODULE II CIRCUIT THEORY FOR WAVEGUIDE SYSTEMS 9

Equivalent voltages and current. Impedance description of waveguide elements and circuits-One port circuit. Foster's Reactance theorem. N-Port Circuits. Two port junctions. Excitation of waveguide-Probe coupling in a rectangular waveguide-Radiation from linear current elements and current loops. Waveguide coupling by apertures-Aperture in a transverse wall-Aperture in broad wall of a waveguide.

MODULE III PERIODIC STRUCTURES 5

Wave analysis of periodic structures. Periodic structures composed of Unsymmetrical two port networks. Terminated periodic structures. Matching of periodic structures. Floquet's Theorem and spatial harmonics.

MODULE IV MICROWAVE FILTERS 4

Microwave filters- Image parameter method. Filter design by insertion loss method. Low pass filter design. Microstrip parallel coupled filter.

MODULE V MICROWAVE SOLID STATE AMPLIFIERS 9

S-parameters - Unilateral design of amplifiers - simultaneous conjugate match. Bilateral design of amplifiers. Amplifier stability. Conditional and unconditional stability criteria. Amplifier power gain. Constant gain circles. Noise temperature concept. Noise factor and noise figure. Noise temperature for cascaded stages. Constant noise figure circles. Design of single stage microwave amplifiers.

MODULE VI MICROWAVES AND OPTICS 9

Geometrical optics as a limiting case of wave optics. Ray matrices for paraxial ray optics. Gaussian beams. Generation of Gaussian beams at microwave frequencies. The beam waist. Propagation of Gaussian beams in Homogeneous medium. Transformation of Gaussian beams with lenses.

TOTAL HOURS : 45

Text Book:

1. R.E.Collin, "Foundations of Microwave Engineering", McGraw-Hill, 1992.

REFERENCES

1. Ramo, Whinnery and Van Duzer, "Fields and Waves in Communication Electronics", 3rd Edition, Wiley, 1997.
2. Pozar, David "Microwave and RF System Design", Wiley, 2001.
3. W.Tomasi, "Advanced Microwave Communication Systems", 2nd Edition, PHI, 2002

OUTCOMES:

On Completion of this course, the students will be able to

- Explain the behavior of transmission lines
- Design different circuits for waveguide systems
- Evaluate and examine the behavior of periodic structures, and microwaves
- Design Microwave amplifiers and analyze its stability
- Design of single stage microwave amplifiers.
- Describe transformation of Gaussian beams with lenses.

ECBX08`	RADAR AND NAVIGATIONAL AIDS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the Principle of Radar and derive range equation of RADAR.
- To learn the different types of Radars and its applications.
- To learn the different types of Radars and its applications.
- To learn the different types of Radars and its applications. To illustrate the Doppler principle in radars and to know about the facts in the detection and tracking.
- To analyze the usage of antennas and its propagation as related to radars and the transceivers.
- To know about the principles of navigation and landing aids.

MODULE I INTRODUCTION TO RADAR 9

Basic Radar –The simple form of the Radar Equation- Radar Block Diagram-Radar Frequencies –Applications of Radar – The Origins of Radar.

MODULE II THE RADAR EQUATION 9

Introduction- Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio- Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency-Antenna Parameters-System losses – Other Radar Equation Considerations

MODULE III TARGET ECHO INFORMATION EXTRACTION 5

Detection – Detection in Noise – Signal Integration and Target Fluctuation – M of N Detection – Threshold Setting Concept (CFAR) – Ranging – Target Velocity – Range and Velocity with CW – Radar Height Finding

MODULE IV MTI AND PULSE DOPPLER RADAR 9

Introduction to Doppler and MTI Radar- Delay –Line Cancelers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) - Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics -Comparison of Trackers - Automatic Tracking with Surveillance Radar (ADT).

MODULE V FUNDAMENTALS OF NAVIGATION 9

Introduction to Navigation - Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders, Radio Ranges - The LF/ MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments.

Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System.

MODULE VI APPLICATIONS OF RADAR 4

DME - TACAN - Microwave Landing System(MLS) - Global Positioning System (GPS)

TOTAL HOURS : 45

Text Book:

1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill, 3rd Edition, 2003.
2. Byron Edde, “Radar Principles, Technology, Applications”, Pearson Education India, 2009.

REFERENCES

1. Peyton Z. Peebles, "Radar Principles", Johnwiley, 2004
2. J.C Toomay, "Principles of Radar", 2nd Edition –PHI, 2004

OUTCOMES:

On Completion of this course, the students will be able to

- Define and describe the basic principle and operation of Radar.
- Describe the working of RADAR and the techniques of detection.
- Apply Doppler principle to radars
- Compare and Analyze different types of Radar and its applications.
- Distinguish the types of antennas and propagation related to radars.
- Illustrate the principle and mechanism involved in the navigational aids

ECBX18	IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing;
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems.

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Components of Image Processing System, Elements of Visual Perception, MTF of Visual System, Image Sensing and Acquisition, Image formation model, Image Sampling & Quantization Spatial and Gray Level Resolution, Basic Relationships between Pixels. Statistical parameters, Measures and their significance, Mean, standard deviation, variance, SNR, PSNR.

MODULE II IMAGE ENHANCEMENT 7

Enhancement in Spatial Domain: basic gray level transformations, histogram processing, equalization, Arithmetic and logical operations between images, Basics of spatial filtering, smoothening and sharpening spatial filters. Image Enhancement in frequency Domain: smoothening and sharpening frequency domain filters. Fundamental of color image processing: color models, RGB, CMY, YIQ, HIS. Pseudo Color Image processing: Intensity filtering, gray level to color transformation, Basics of full color image processing.

MODULE III IMAGE TRANSFORMS 7

2D-DFT, FFT, DCT, the KL Transform, Walsh/Hadamard Transform, Haar Transform.

MODULE IV IMAGE CODING AND COMPRESSION 7

Image Coding Fundamentals, Image Compression Model, fundamentals-redundancy: coding, interpixel, psychovisual, fidelity criteria, elements of information theory. Error Free Compression - variable length, bit plane, Lossless Predictive, Lossy Compression- Lossy Predictive. Fundamentals of JPEG, MPEG, fractals.

MODULE V IMAGE ANALYSIS 7

Edge detection, spatial feature and boundary extraction, boundary representation by chain codes and B splines, Hough Transform. Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images, Segmentation: Point, line. Edge detection, Boundary detection and Thersholding.

MODULE VI IMAGE RESTORATION AND IMAGE PROCESSING APPLICATIONS 9

Image Degradation Model, Noise Models, and Restoration in Presence of Noise in spatial Domain, Linear Filtering, Applications: Character Recognition, Fingerprint Recognition, Remote Sensing. Applications using different Imaging modalities such as acoustic Imaging, Medical imaging, electron microscopy etc.

TOTAL HOURS : 45

Text Book:

1. Gonzalez and Woods, "Digital Image Processing", Pearson Education, 2009.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

REFERENCES

1. A. K. Jain, "Fundamentals of Digital Image Processing"; PHI, 2006
2. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.

OUTCOMES:

At the completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Identify and use appropriate image compression techniques
- Apply various techniques for image analysis and restoration.
- Apply suitable image processing techniques in different applications

PROFESSIONAL ELECTIVE

VLSI & EMBEDDED SYSTEMS

		L	T	P	C
ECBX09	**ADVANCED MICROPROCESSOR AND MICROCONTROLLERS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To familiarize with architecture and instruction set of advanced microprocessor and microcontroller.
- To develop the algorithm and writing assembly language programs for advanced microprocessor and microcontroller.
- To learn the interface of peripheral devices with microprocessor and microcontroller.

MODULE I MICROPROCESSORS ARCHITECTURE 8

Introduction - Concepts of CISC- RISC-multi-processing - multi-user - multitasking - Segmentation- Cache Memory - Pipelining- pipeline hazards.

MODULE II HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM 7

CPU Architecture - Bus Operations - Pipelining - Branch prediction - floating point unit - Pentium memory management.

MODULE III OPERATING MODES OF PENTIUM AND PROGRAMMING 8

Operating Modes - Multitasking - Exception and Interrupts - Instruction set - addressing modes Basic programming the Pentium Processor.

MODULE IV PIC MICROCONTROLLER CPU 7

Architecture - Instruction set - interrupts - Assembly language programming and introduction to C-Compilers.

MODULE V PIC COMMUNICATION INTERFACE 7

Timers- I2C Interfacing - UART- A/D Converter -PWM

MODULE VI HIGH PERFORMANCE RISC ARCHITECTURE – ARM 8

Organization of CPU - Bus architecture -Memory management unit - ARM instruction sets - addressing modes.

TOTAL HOURS : 45

Text Book:

1. Daniel Tabak , " Advanced Microprocessors", McGraw Hill.Inc., 1995.
2. B.B.Brey, "The Intel Microprocessor 8086/8088, 80186/80188, 80286, 80386, 80486, PENTIUM, PENTIUM Pro, PII, PIII & IV Architecture, Programming & Interfacing", 7th Edition, Prentice-Hall of India, 2006.

3. John .B.Peatman, "Design with PIC Microcontroller", Prentice hall, 1997.

4. Steave Furber, "ARM system - on - chip architecture", Addison Wesley, 2000.

REFERENCES

1. K. Ray and K.M.Bhurchandani, "Advanced Microprocessors and Peripherals", TMH, 2nd edition 2006.

2. James L. Antonakos, " The Pentium Microprocessor" Pearson Education , 1997.

3. John Paul Shen, Mikko H.Lipasti, "Modern Processor Design", Tata McGraw Hill, 2006.

OUTCOMES:

On completion of this course the students will be able to

- Categorize the CISC and RISC type of processors .
- Identify the addressing modes for various instructions of advanced microprocessor and microcontroller.
- Analyze pipeline hazards in advanced microprocessor and microcontroller.
- Develop an algorithm and write programs for PENTIUM and PIC .
- Explain the architecture of PENTIUM, PIC and ARM.
- Design interfacing mechanism for various peripheral devices with microcontrollers.

ECBX10	REAL TIME OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the aspects of the Operating systems and Real-time Operating Systems
- To analyze the unique issues in the design and analysis of computer systems for real-time applications.
- To describe Resource management, time-constrained communication, scheduling and imprecise computations, real-time kernels and case studies.

MODULE I REVIEW OF OPERATING SYSTEMS 7

Basic Principles - System Calls - Files - Processes - Design and Implementation of processes - Communication between processes - Operating System structures - System Boot.

MODULE II PROCESS MANAGEMENT 8

Process Concept - Process Scheduling - Operation on Process - Co-operating on Process -Inter Process Communication - Synchronization - The Critical-Section Problem.

MODULE III DISTRIBUTED OPERATING SYSTEMS 7

Topology - Network types - Communication - RPC - Client server model -Distributed file system - Design strategies.

MODULE IV OVERVIEW OF RTOS 8

RTOS - Tasks and Task states - Semaphores - Shared data - Message queues, Mail boxes and pipes - Critical section - Semaphores - Classical synchronization problem - Deadlocks-Memory management.

MODULE V REAL TIME KERNEL 8

Principles - Design issues - Polled Loop Systems - RTOS Porting to a Target - Comparison and study of various RTOS like QNX - VX works - C Executive - Case studies.

MODULE VI RTOS APPLICATION DOMAINS 7

RTOS for Image Processing - Embedded RTOS for voice over IP - RTOS for fault Tolerant Applications - RTOS for Control Systems.

TOTAL HOURS : 45

Text Book:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 6th Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2003.
2. Herma K., "Real Time Systems - Design for distributed Embedded Applications", Kluwer Academic, 1997.

3. Charles Crowley, "Operating Systems-A Design Oriented approach", McGraw Hill 1997.

4. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI 1999.

5. Mukesh Sighal and N. G. Shi, "Advanced Concepts in Operating System", McGraw Hill 2000.

OUTCOMES:

After successful completion of the course, the students will be able to:

- Describe various task assignment and scheduling methods of operating system and real time operating system.
- Solve the task synchronization problem using synchronization techniques.
- Describe the design strategies in the distributed operating system.
- Analyze the use of synchronization techniques in real-time systems.
- Diagnose common types of fault tolerance methods that occur in embedded systems.
- Justify the type of real time operating system needed for particular application.

ECBX11	DIGITAL VLSI TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce different techniques for detection of faults in digital circuits.
- To develop a Generation of test vectors for combinational and sequential circuits
- To establish Self-testing methods

MODULE I BASICS OF TESTING 7

Introduction to Testing - Role of testing - VLSI Realisation process- VLSI Technology Trends Affecting Testing-Types of Testing -ATE -AC and DC parameters testing and yield.

MODULE II FAULT MODELLING AND SIMULATION 8

Functional Versus Structural Testing-Faults in digital circuits - Modelling of faults-Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation

MODULE III TESTING OF COMBINATIONAL CIRCUITS 8

Combinational logic circuits -test generation, Testable combinational logic circuit design

MODULE IV TESTING OF SEQUENTIAL CIRCUITS 8

Test generation for sequential circuits - design of testable sequential circuits.

MODULE V DESIGN FOR TESTABILITY 7

Design for Testability - Ad-hoc design - scan based design.

MODULE VI SELF TESTING 7

Built-In Self Test - Test pattern generation for BIST - Circular BIST - BIST Architectures

TOTAL HOURS : 45

REFERENCES

1. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
2. A.L. Crouch, "Design Test for Digital ICs and Embedded Core Systems", Prentice Hall International, 2002.

OUTCOMES:

On completion of the course, students will be able to

- To comprehend the standard procedures and principles to test digital VLSI circuits
- Apply the testing principles to test digital circuits logically using stuck at faults models.
- Analyze and compare the performance of the fault models used to perform testing of digital circuits.
- To apply the design for test (DFT) principles for designing digital systems.

- To generate test vectors using ATPG algorithms for combinational and sequential circuits
- To function in teams involving the testing of digital VLSI systems

ECBX12	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic architecture and operation of a digital computer.
- To study the operation of arithmetic unit including the algorithms & implementation of fixed-point and floating-point arithmetic operations.
- To understand the concept of pipelining.
- To study the hierarchical memory system including cache memories and virtual memory.
- To impart knowledge on I/O devices and standard I/O interfaces.

MODULE I BASIC STRUCTURE OF COMPUTERS 8

Functional units- Basic Operational Concepts, Bus Structures, Software Performance - Memory locations & addresses - Memory operations - Instruction and instruction sequencing - Addressing modes - Assembly language - Basic I/O operations - Stacks and queues.

MODULE II ARITHMETIC OPERATIONS 9

Addition and subtraction of signed numbers - Design of fast adders - Multiplication of positive numbers- Signed operand multiplication and fast multiplication - Integer division - floating point numbers and operations.

MODULE III BASIC PROCESSING UNIT 6

Fundamental concepts - Execution of a complete Instruction - Multiple bus organization - Hardwired control - Microprogrammed control- Nano Programming.

MODULE IV PIPE LINE CONCEPTS 6

Pipelining - Basic concepts - Data hazards - Instruction hazards - Influence on Instruction sets - Data path and control consideration - Superscalar operation.

MODULE V MEMORY SYSTEM 9

Basic concepts - Semiconductor RAMs, ROMs - Speed, size and cost -Associative memory - Cache memories - Performance consideration - Virtual memory- Memory Management requirements - Secondary storage.

MODULE VI I/O ORGANIZATION 7

Accessing I/O devices - Interrupts - Interrupt Priority- Data transfer Schemes-Buses - Interface Circuits - Standard I/O Interfaces (PCI and USB).

TOTAL HOURS : 45

Text Book:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization" 5th Edition, McGraw Hill, 2002.

2. Morris Mano, "Computer System Architecture", 3rd Edition, PHI, 2001.

REFERENCES

1. William Stallings, "Computer Organization & Architecture - Designing for Performance", 6th Edition, Pearson Education, 2003 reprint.

2. David A.Patterson and John L.Hennessy, "Computer Organization & Design, the hardware / software interface", 2nd Edition, Morgan Kaufmann, 2002 reprint.

3. John P.Hayes, "Computer Architecture & Organization", 3rd Edition, McGraw-Hill, 1998.

OUTCOMES:

On completion of this course the students will able to

- Explain the evolution of computer system.
- Describe the operation of modern CPUs including pipelining, memory system, computer arithmetic and buses.
- Design and emulate a single cycle or pipelined CPU and handle different types of hazards.
- Explain the wide variety of memory technologies and learn partitioning of memory.
- Appraise the cost performance issues and design trade offs in designing and constructing a computer processor including memory.
- Evaluate the quantitative performance of computer systems

ECBX13	ADVANCED DIGITAL SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The student will gain knowledge in the design of asynchronous sequential circuits, fault modeling and simulation.

MODULE I ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 7

Flow Table Reduction -State Assignment - Problem and the Transition Table - Design of ASC - Static and Dynamic Hazards - Essential Hazards -Designing Vending Machine Controller.

MODULE II STATE MACHINE CHARTS 8

SM Chart - derivation of SM Chart- SM chart for Binary Multiplier, Realization of SM Chart.

MODULE III DIGITAL SYSTEM DESIGN USING PLD 8

ROM, EPROM, EEPROM, PLE, Sequential circuit realization using PLEs

MODULE IV LOGIC CELL ARRAY 8

Logic block, I/O block, programmable interconnect, memory configuration - XC2000 series, XC 3000 series, Logic design using cell array, state machine design using cell array.

MODULE V FAULT MODELING 7

Logical fault model, Fault detection & Redundancy in combinational, sequential circuits, Fault Equivalence and Fault location in Combinational & sequential Circuits. Single stuck fault model, Multiple stuck fault model.

MODULE VI FAULT TESTING 7

Basic issues, Automatic test generator for single stuck fault in combinational circuits, D Algorithm, Path oriented Decision Making Algorithm, ATG systems, Test set compaction

TOTAL HOURS : 45

REFERENCES

1. Donald G. Givone,"Digital principles and Design", Tata McGraw Hill 2002.
2. John M Yarbrough, "Digital Logic appns. and Design", Thomson Learning, 2001
3. Charles H. Roth Jr., "Fundamentals of Logic design", Thomson Learning, 2004.
4. Stephen Brown and Zvonk Vranesic,"Fundamentals of Digital Logic with VHDL Design", Tata McGraw Hill, 2002.
5. Navabi.Z. "VHDL Analysis and Modeling of Digital Systems", McGraw Hill,1998.
6. Parag K Lala, "Digital System design using PLD", BS Publications, 2003 .

OUTCOMES:

At the end of the course students will be able to

- Analyze asynchronous sequential circuits and design simple asynchronous digital system for the given specifications.
- Make use of state machines and ASM charts for the given design requirements.
- Select and use appropriate PLDs to realize digital systems based on the requirements.
- Test the faults in the digital circuits using stuck at fault models.
- Generate test vectors using ATPG algorithms and analyze its performance.
- Apply digital system design principles and make projects based on the requirements.

ECBX14	VLSI SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn different algorithms used for DSP processors and fundamentals of pipelining and parallel processing on FIR filters.
- To study the concepts of retiming, unfolding, transforms and rank order filters.
- To understand different fast convolution algorithms and pipelining/parallel processing techniques for IIR filters.
- To study different bit level architectures and their complexities.
- To study the general architectures of programmable Digital signal processors.

MODULE I INTRODUCTION TO DSP SYSTEMS 5

Typical DSP algorithms: Convolution, correlation, Digital filters, Adaptive filters, Discrete cosine transform Decimators and Expanders, wavelets and filter banks, DSP application demands and scaled CMOS technologies, Representation of DSP Algorithms

MODULE II PIPELINING AND PARALLEL PROCESSING 9

Data flow graph representations, loop bound and iteration bound, Algorithms for computing iteration bound: Longest path Matrix algorithm, Iteration bound for multirated data flow graphs Pipelining and parallel processing - Pipelining of FIR digital filters, parallel processing, pipelining and parallel processing for low power.

MODULE III RETIMING, UNFOLDING AND FOLDING 9

Definitions and properties of retiming, an algorithm for unfolding, properties of unfolding, Applications of unfolding: sample period reduction , parallel processing, folding transformation, Register minimization techniques, Register minimization in folded architectures, Folding of multirated systems.

MODULE IV FAST CONVOLUTION AND ALGORITHMIC STRENGTH REDUCTION IN FILTERS AND TRANSFORMS 9

Cook Toom algorithm, modified Cook-Took algorithm, parallel FIR filter, 2-parallel fast FIR filter, DCT algorithm architecture transformation, parallel architectures for rank-order filters, odd- even merge- sort architecture, parallel rank-order filters, low power rank order filters.

MODULE V BIT LEVEL ARITHEMATIC ARCHITECTURES 9

Parallel multipliers with sign extension, parallel carry-ripple array multipliers,parallel carry-save multiplier, bit Baugh-Wooley multipliers, parallel multipliers with modified booth recoding, Bit serial multipliers, Bit serial filter design and implementation multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement.

MODULE VI PROGRAMMABLE DIGITAL SIGNAL PROCESSORS 4

Introduction, evolution of programmable DSP, important features of DSP processors, DSP processors for mobile and wireless communication, processors for multimedia signal processing.

TOTAL HOURS : 45

REFERENCES

1. Keshab K.Parhi, "VLSI Digital Signal Processing systems, Design and implementation", Wiley, Inter Science, 1999.
2. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw-Hill, 1994.
3. S.Y. Kung, H.J.White House,T.Kailath,"VLSI and Modern Signal Processing ", Prentice Hall,1985.

OUTCOMES:

On completion of the course, students will be able to

- Understand various algorithms that can be designed and applied on application specific VLSI architecture.
- Have knowledge on fast convolution algorithms and high speed multipliers.
- Gain minimum knowledge to find solution for any research queries on DSP processors.
- Apply the advantages retiming, unfolding and folding on pipelined and parallel processed architectures.
- Have the ability to develop advanced DSP filters and processors.
- Be able to develop optimized DSP designs by employing the advantages of VLSI concepts.

ECBX15	ASIC DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

To learn

- The concept of semicustom and programmable ASIC types.
- The fundamentals of digital logic design and the physical features of each ASIC.
- ASIC logic design, partitioning, floor planning, placement, and routing.

MODULE I INTRODUCTION TO CMOS 6

CMOS transistors- process, CMOS current equation- CMOS inverter characteristics and Design rules.

MODULE II INTRODUCTION TO ASICs 7

ASIC introduction - advantages- Types of ASICs - Full Custom, Semi custom and programmable ASICs- ASIC Design flow.

MODULE III CMOS LOGIC DESIGN AND ASIC LIBRARY DESIGN 8

CMOS Combinational Logic Cell - Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance.

MODULE IV PROGRAMMABLE ASICs AND LOGIC CELLS 8

Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA -Altera FLEX - Altera MAX.

MODULE V PROGRAMMABLE ASIC INTERCONNECT 8

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX9000 - Altera FLEX.

MODULE VI PARTITIONING, FLOOR PLANNING, PLACEMENT & ROUTING 8

Partitioning methods - floor planning - placement - global routing - detailed routing.

TOTAL HOURS : 45

REFERENCES

1. M.J.S .Smith, "Application Specific Integrated Circuits", Addison -Wesley Longman Inc., 1997.
2. Andrew Brown, "VLSI Circuits and Systems in Silicon", McGraw Hill, 1991
3. S.D. Brown, R.J. Francis, J. Rox, Z.G. Vranesic, "Field Programmable Gate Arrays", Kluwer Academic Publishers, 1992.
4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.

5. S. Y. Kung, H. J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.

6. Jose E. France, Yannis Tsividis, "Design of Analog & Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

OUTCOMES:

On completion of the course, students will be able to

- Apply the appropriate layout rules while carrying transistor level circuit design.
- Interpret appropriate ASIC types based on application and requirements.
- Design data path circuits required for ASIC chip.
- Illustrate required types of programming technologies as well as logic cells based on applications.
- Choose type of interconnects required for the ASIC chip.
- Select appropriate algorithm to perform back end design such as partitioning, floor planning, placement & routing.

ECBX16	RECONFIGURABLE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

To learn

- Basic concepts of Reconfigurable computing
- Modeling and programming various reconfigurable systems
- Design and development of Various Reconfigurable architectures.
- Applications development of reconfigurable systems.

MODULE I RECONFIGURABLE COMPUTING HARDWARE 9

Device Architecture- The Computational Fabric- Array and Interconnect-Extending Logic-Configuration-Reconfigurable Processing Fabric Architectures- -RPF Integration into Traditional Computing Systems-Reconfigurable Computing Systems - Configuration Architectures- Managing the Reconfiguration Process- Reducing Configuration Transfer Time.

MODULE II PROGRAMMING RECONFIGURABLE SYSTEMS 6

Technology Mapping- Structural Mapping Algorithms- Integrated Mapping Algorithms-Mapping Algorithms for Heterogeneous Resources- FPGA Placement- Placement Problem-Clustering- Partition-based Placement-Analytic Placement- Datapath Composition-Fundamentals- The Impact of Device Architecture- The Interface to Module Generators-Mapping_Placement-Compaction.

MODULE III MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS 9

Technology Mapping- Structural Mapping Algorithms- Integrated Mapping Algorithms-Mapping Algorithms for Heterogeneous Resources- FPGA Placement- Placement Problem-Clustering- Partition-based Placement-Analytic Placement- Datapath Composition-Fundamentals- The Impact of Device Architecture- The Interface to Module Generators-Mapping_Placement-Compaction.

MODULE IV RETIMING AND FAST COMPILATION 7

Retiming: Concepts, Algorithm, and Restrictions- Re-pipelining and C-slow Retiming-Implementations of Retiming- Retiming on Fixed-frequency FPGAs-C-slowing as Multi-threading- Fast Compilation Techniques- Accelerating Classical Techniques- Alternative Algorithms- Effect of Architecture.

MODULE V APPLICATION DEVELOPMENT 8

Implementing Applications with FPGAs- Strengths and Weaknesses of FPGAs-Application Characteristics and Performance- General Implementation Strategies for FPGA-based Systems- Implementing Arithmetic in FPGAs-Instance-specific Design- Partial Evaluation-Distributed Arithmetic- FPGA Implementation of CORDIC Processors- Hardware/Software Partitioning.

MODULE VI CASE STUDIES OF FPGA APPLICATIONS 6

SPIHT Image Compression- Automatic Target Recognition Systems- Multi- FPGA Systems: Logic Emulation.

TOTAL hours : 45

Text Book:

1. Scott Hauck and Andr´e DeHon, "Reconfigurable Computing :The Theory And Practice of FPGA-Based Computation". Morgan Kaufmann Publishers, 2008.

REFERENCES

1. M.Gokhale and P.Graham, "Reconfigurable Computing: Accelerating Computation with Field Programmable Gate Arrays", Springer Publications, 2005.
2. C.Bobda," Introduction to Reconfigurable Computing: Architectures, Algorithms and Applications", Springer Publications, 2007.

OUTCOMES:

On completion of the course, students will be able to

- Analyze various reconfigurable architectures.
- Apply various methodologies to reconfigure FPGA.
- Implement fast compilation techniques in architecture design.
- Develop modules and applications using high level languages and tools.
- Design and build an SOPC for a specific application
- Design FPGA and programming reconfigurable systems

ECBX18	IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing;
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems.

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Components of Image Processing System, Elements of Visual Perception, MTF of Visual System, Image Sensing and Acquisition, Image formation model, Image Sampling & Quantization Spatial and Gray Level Resolution, Basic Relationships between Pixels. Statistical parameters, Measures and their significance, Mean, standard deviation, variance, SNR, PSNR.

MODULE II IMAGE ENHANCEMENT 7

Enhancement in Spatial Domain: basic gray level transformations, histogram processing, equalization, Arithmetic and logical operations between images, Basics of spatial filtering, smoothening and sharpening spatial filters. Image Enhancement in frequency Domain: smoothening and sharpening frequency domain filters. Fundamental of color image processing: color models, RGB, CMY, YIQ, HIS. Pseudo Color Image processing: Intensity filtering, gray level to color transformation, Basics of full color image processing.

MODULE III IMAGE TRANSFORMS 7

2D-DFT, FFT, DCT, the KL Transform, Walsh/Hadamard Transform, Haar Transform.

MODULE IV IMAGE CODING AND COMPRESSION 7

Image Coding Fundamentals, Image Compression Model, fundamentals-redundancy: coding, interpixel, psychovisual, fidelity criteria, elements of information theory. Error Free Compression - variable length, bit plane, Lossless Predictive, Lossy Compression- Lossy Predictive. Fundamentals of JPEG, MPEG, fractals.

MODULE V IMAGE ANALYSIS 7

Edge detection, spatial feature and boundary extraction, boundary representation by chain codes and B splines, Hough Transform. Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images, Segmentation: Point, line. Edge detection, Boundary detection and Thersholding.

MODULE VI MODULE VI IMAGE RESTORATION AND IMAGE PROCESSING APPLICATIONS 9

Image Degradation Model, Noise Models, and Restoration in Presence of Noise in spatial Domain, Linear Filtering, Applications: Character Recognition, Fingerprint Recognition, Remote Sensing. Applications using different Imaging modalities such as acoustic Imaging, Medical imaging, electron microscopy etc.

TOTAL HOURS : 45

Text Book:

1. Gonzalez and Woods, "Digital Image Processing", Pearson Education, 2009.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

REFERENCES

1. A.K. Jain, "Fundamentals of Digital Image Processing"; PHI, 2006
2. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Identify and use appropriate image compression techniques
- Apply various techniques for image analysis and restoration.
- Apply suitable image processing techniques in different applications

PROFESSIONAL ELECTIVE

SIGNAL PROCESSING

ECBX17	**ADVANCED DIGITAL SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To introduce the concept of discrete random signal processing
- To estimate the spectrum of Discrete Random Signals
- To model and design adaptive filters
- To explain the concepts of multirate signal processing

MODULE I DISCRETE RANDOM SIGNAL PROCESSING 8

Weiner Khitchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem, special types of random process – Signal modeling-Least Squares method, Pade approximation, Prony's method.

MODULE II SPECTRUM ESTIMATION 7

Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrum estimation - Welch estimation - Model based approach - AR, MA, ARMA Signal modeling – Parameter estimation using Yule-Walker method.

MODULE III LINEAR ESTIMATION 6

Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion - Wiener filter - Discrete Wiener Hoff equations - Recursive Bayesian Estimation.

MODULE IV LINEARPREDICTION 8

Linear prediction, Prediction error - Whitening filter, Inverse filter - Levinson recursion, Lattice realization, Levinson recursion algorithm for solving Toeplitz system of equations.

MODULE V ADAPTIVE FILTERS 8

FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on steepest descent method - Widrow Hoff LMS Adaptive algorithm -Adaptive channel equalization – Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive filters.

MODULE VI MULTIRATE DIGITAL SIGNAL PROCESSING 8

Mathematical description of change of sampling rate - Interpolation and Decimation – Decimation by integer factor - Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Applications to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

TOTAL HOURS : 45

REFERENCES

1. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons Inc., New York, 2006.
2. Sophoncles J. Orfanidis, “Optimum Signal Processing “, McGraw-Hill, 2000.
3. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing”, Prentice Hall of India, New Delhi, 2005.
4. Simon Haykin, “Adaptive Filter Theory”, Prentice Hall, Englehood Cliffs, NJ1986.
5. S. Kay,” Modern spectrum Estimation theory and application”, Prentice Hall, Englehood Cliffs, NJ1988.
6 P. P. Vaidyanathan, “Multirate Systems and Filter Banks”, Prentice Hall, 1992.

OUTCOMES:

On completion of the course, students will be able to

- Classify and model random signals
- Estimate the spectrum of discrete signals
- Apply various linear estimation techniques
- Recognize and use optimum filters for signal prediction
- Implement an appropriate filter for given application
- Apply multirate signal processing techniques in multimedia applications

ECBX18	IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing;
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems.

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Components of Image Processing System, Elements of Visual Perception, MTF of Visual System, Image Sensing and Acquisition, Image formation model, Image Sampling & Quantization Spatial and Gray Level Resolution, Basic Relationships between Pixels. Statistical parameters, Measures and their significance, Mean, standard deviation, variance, SNR, PSNR.

MODULE II IMAGE ENHANCEMENT 7

Enhancement in Spatial Domain: basic gray level transformations, histogram processing, equalization, Arithmetic and logical operations between images, Basics of spatial filtering, smoothening and sharpening spatial filters. Image Enhancement in frequency Domain: smoothening and sharpening frequency domain filters. Fundamental of color image processing: color models, RGB, CMY, YIQ, HIS. Pseudo Color Image processing: Intensity filtering, gray level to color transformation, Basics of full color image processing.

MODULE III IMAGE TRANSFORMS 7

2D-DFT, FFT, DCT, the KL Transform, Walsh/Hadamard Transform, Haar Transform.

MODULE IV IMAGE CODING AND COMPRESSION 7

Image Coding Fundamentals, Image Compression Model, fundamentals-redundancy: coding, interpixel, psychovisual, fidelity criteria, elements of information theory. Error Free Compression - variable length, bit plane, Lossless Predictive, Lossy Compression- Lossy Predictive. Fundamentals of JPEG, MPEG, fractals.

MODULE V IMAGE ANALYSIS 7

Edge detection, spatial feature and boundary extraction, boundary representation by chain codes and B splines, Hough Transform. Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images, Segmentation: Point, line. Edge detection, Boundary detection and Thersholding.

MODULE VI MODULE VI IMAGE RESTORATION AND IMAGE PROCESSING APPLICATIONS 9

Image Degradation Model, Noise Models, and Restoration in Presence of Noise in spatial Domain, Linear Filtering, Applications: Character Recognition, Fingerprint Recognition, Remote Sensing. Applications using different Imaging modalities such as acoustic Imaging, Medical imaging, electron microscopy etc.

TOTAL HOURS : 45

Text Book:

1. Gonzalez and Woods, "Digital Image Processing", Pearson Education, 2009.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

REFERENCES

1. A.K. Jain, "Fundamentals of Digital Image Processing"; PHI, 2006
2. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Identify and use appropriate image compression techniques
- Apply various techniques for image analysis and restoration.
- Apply suitable image processing techniques in different applications

ECBX19 DSP ARCHITECTURE AND PROGRAMMING L T P C

OBJECTIVES:

- To describe the architecture of programmable digital signal processor
- To implement basic DSP functions in processor TMS320C5XX:
- To apply TMS320C5XX for real time applications.

MODULE I FUNDAMENTALS OF DSP PROCESSORS 7

Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory, Multi-ported memory, VLIW architecture, Pipelining, Special Addressing modes in P-DSPs, on chip Peripherals.

MODULE II COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATION 7

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementation, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors

MODULE III ARCHITECTURES OF DIGITAL SIGNAL PROCESSOR 9

Basic Architectural features, DSP computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed issues Features for External interfacing.

MODULE IV PROGRAMMABLE DIGITAL SIGNAL PROCESSORS 10

Commercial Digital signal-processing Devices, TMS320C54XX DSP: Data Addressing mode, Memory space, Program Control, Instructions and Programming, On-Chip peripherals, Interrupts, Pipeline Operation

MODULE V TMS320C6XDSPs 6

Introduction, features of TMS320C6X processor, internal architecture, functional units and its operations, addressing modes in C6x, memory architecture, peripherals.

MODULE VI VI IMPLEMENTATION OF BASIC DSP ALGORITHMS 6

The Q-notation,FIR Filters, IIR Filters, interpolation Filters, Decimation filters, Adaptive Filters, 2-D signal processing, An FFT Algorithm for DFT Computation, Computation of signal spectrum.

TOTAL HOURS : 45

Text Book:

1. B. Venkataramani, M. Bhaskar "Digital Signal Processors: Architecture, Programming and Applications", Tata McGraw-Hill Education, 2002
2. Avtar Singh, S.Srinivasan ,"DSP Implementation using DSP microprocessor with Examples from TMS32C54XX" -Thamson 2004

3. Sen-Maw Kuo, Woon-SengGan,"Digital signal processors architectures, implementations, and applications", Pearson Prentice Hall, 2005 .

REFERENCES

1. Phil Lapsley, Jeff Bier, Amit Shohan, Edward A Lee, “DSP Processor Fundamentals, Architectures & Features”. S. Chand & Co, 2000.
2. Jonathan Stein, “Digital signal processing” John Wiley 2005.
3. S.K. Mitra, “Digital Signal Processing”, Tata McGraw-Hill Publication, 2001.
4. Alan V. Oppenheim,"Discrete-Time Signal Processing", Pearson Education India, 2006.

OUTCOMES:

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

- Recognize the fundamentals of fixed and floating point architectures of various DSPs.
- Estimate DSP computational errors.
- Describe the architectural features of DSP processors
- Select appropriate DSP processors for signal processing applications
- Make use of TMS3206X processors in real time applications
- Implement various DSP algorithms

ECBX12	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic architecture and operation of a digital computer.
- To study the operation of arithmetic unit including the algorithms & implementation of fixed-point and floating-point arithmetic operations.
- To understand the concept of pipelining.
- To study the hierarchical memory system including cache memories and virtual memory.
- To impart knowledge on I/O devices and standard I/O interfaces.

MODULE I BASIC STRUCTURE OF COMPUTERS 8

Functional units- Basic Operational Concepts, Bus Structures, Software Performance - Memory locations & addresses - Memory operations - Instruction and instruction sequencing - Addressing modes - Assembly language - Basic I/O operations - Stacks and queues.

MODULE II ARITHMETIC OPERATIONS 9

Addition and subtraction of signed numbers - Design of fast adders - Multiplication of positive numbers- Signed operand multiplication and fast multiplication - Integer division - floating point numbers and operations.

MODULE III BASIC PROCESSING UNIT 6

Fundamental concepts - Execution of a complete Instruction - Multiple bus organization - Hardwired control - Microprogrammed control- Nano Programming.

MODULE IV PIPE LINE CONCEPTS 6

Pipelining - Basic concepts - Data hazards - Instruction hazards - Influence on Instruction sets - Data path and control consideration - Superscalar operation.

MODULE V MEMORY SYSTEM 9

Basic concepts - Semiconductor RAMs, ROMs - Speed, size and cost -Associative memory - Cache memories - Performance consideration - Virtual memory- Memory Management requirements - Secondary storage.

MODULE VI I/O ORGANIZATION 7

Accessing I/O devices - Interrupts - Interrupt Priority- Data transfer Schemes-Buses - Interface Circuits - Standard I/O Interfaces (PCI and USB).

TOTAL HOURS : 45

Text Book:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization" 5th Edition, McGraw Hill, 2002.

2. Morris Mano, "Computer System Architecture", 3rd Edition, PHI, 2001.

REFERENCES

1. William Stallings, "Computer Organization & Architecture - Designing for Performance", 6th Edition, Pearson Education, 2003 reprint.

2. David A.Patterson and John L.Hennessy, "Computer Organization & Design, the hardware / software interface", 2nd Edition, Morgan Kaufmann, 2002 reprint.

3. John P.Hayes, "Computer Architecture & Organization", 3rd Edition, McGraw-Hill, 1998.

OUTCOMES:

On completion of this course the students will able to

- Explain the evolution of computer system.
- Describe the operation of modern CPUs including pipelining, memory system, computer arithmetic and buses.
- Design and emulate a single cycle or pipelined CPU and handle different types of hazards.
- Explain the wide variety of memory technologies and learn partitioning of memory.
- Appraise the cost performance issues and design tradeoffs in designing and constructing a computer processor including memory.
- Evaluate the quantitative performance of computer systems

ECBX20	BIOMEDICAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the methods of recording various bio-potentials.
- To introduce the processing techniques of biomedical signals and parameter detection.
- To discuss recent techniques in bio medical signal processing
- To introduce modern industrial biomedical applications

MODULE I INTRODUCTION TO BIOMEDICAL SIGNALS 6

The origin of Bio-potentials-Bio-potential Electrodes-Biological amplifiers-ECG, EEG, EMG, PCG, EOG- Lead systems and Recording Methods- Typical waveforms and signal characteristics.

MODULE II PROCESSING OF BIOMEDICAL SIGNAL 8

Review of linear systems -Time Frequency Analysis of biomedical signals-Processing of Random & Stochastic signals - spectral estimation - Properties and effects of noise in biomedical instruments - Filtering in biomedical instruments- Modeling of Biomedical signals - Detection of biomedical signals in noise.

MODULE III ANALYSIS OF ECG 9

ECG parameters estimation-Multi-Scale analysis for parameter estimation of ECG waveforms-Arrhythmia Analysis Monitoring-Continuous ECG recording-Direct data compression techniques- Direct ECG data compression techniques- Transformation compression techniques-MATLAB Simulation of analyzing ECG.

MODULE IV NEUROLOGICAL APPLICATIONS 9

EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications-Epilepsy-sleep disorders-brain computer interface-Modeling EEG- linear, stochastic models - Non linear modeling of EEG - artifacts in EEG & their characteristics and processing - Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis - correlation analysis of EEG channels - coherence analysis of EEG channels.

MODULE V BIO-TELEMETRY 7

Telemetry principles- Frequency selection- Bio-telemetry- Radio-pill and Tele-stimulation.

MODULE VI MODULE VI MODERN INDUSTRIAL BIOMEDICAL APPLICATIONS 6

Case Study HL7 Protocol- Patient Monitoring System - Nano medicine and application.

TOTAL HOURS : 45

Text Book:

1. D.C.Reddy, "Biomedical Signal Processing: Principles and techniques", Tata McGraw Hill, New Delhi, 2005

REFERENCES

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 1997.
2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 1997.
3. Leislie Cromwell, "Biomedical instrumentation and measurement", Prentice Hall of India, New Delhi, 2002.

OUTCOMES:

On completion of the course, students will be able to

- Describe the characteristics of various Bio medical signals.
- Analyze linear and nonlinear methods of random and stochastic signals
- Model linear and nonlinear systems.
- Analyze the ECG signals and its compression techniques.
- Extract the linear and nonlinear parameters of Bio medical signals using the MATLAB simulation.
- Summarize the biotelemetry and modern technologies in hospital applications.

ECBX14	VLSI SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn different algorithms used for DSP processors and fundamentals of pipelining and parallel processing on FIR filters.
- To study the concepts of retiming, unfolding, transforms and rank order filters.
- To understand different fast convolution algorithms and pipelining/parallel processing techniques for IIR filters.
- To study different bit level architectures and their complexities.
- To study the general architectures of programmable Digital signal processors.

MODULE I INTRODUCTION TO DSP SYSTEMS 5

Typical DSP algorithms: Convolution, correlation, Digital filters, Adaptive filters, Discrete cosine transform Decimators and Expanders, wavelets and filter banks, DSP application demands and scaled CMOS technologies, Representation of DSP Algorithms

MODULE II PIPELINING AND PARALLEL PROCESSING 9

Data flow graph representations, loop bound and iteration bound, Algorithms for computing iteration bound: Longest path Matrix algorithm, Iteration bound for multirated data flow graphs Pipelining and parallel processing - Pipelining of FIR digital filters, parallel processing, pipelining and parallel processing for low power.

MODULE III RETIMING, UNFOLDING AND FOLDING 9

Definitions and properties of retiming, an algorithm for unfolding, properties of unfolding, Applications of unfolding: sample period reduction , parallel processing, folding transformation, Register minimization techniques, Register minimization in folded architectures, Folding of multirated systems.

MODULE IV FAST CONVOLUTION AND ALGORITHMIC STRENGTH REDUCTION IN FILTERS AND TRANSFORMS 9

Cook Toom algorithm, modified Cook-Took algorithm, parallel FIR filter, 2-parallel fast FIR filter, DCT algorithm architecture transformation, parallel architectures for rank-order filters, odd- even merge- sort architecture, parallel rank-order filters, low power rank order filters.

MODULE V BIT LEVEL ARITHEMATIC ARCHITECTURES 9

Parallel multipliers with sign extension, parallel carry-ripple array multipliers,parallel carry-save multiplier, bit Baugh-Wooley multipliers, parallel multipliers with modified booth recoding, Bit serial multipliers, Bit serial filter design and implementation multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement.

MODULE VI PROGRAMMABLE DIGITAL SIGNAL PROCESSORS 4

Introduction, evolution of programmable DSP, important features of DSP processors, DSP processors for mobile and wireless communication, processors for multimedia signal processing.

TOTAL HOURS : 45

REFERENCES

1. Keshab K.Parhi, "VLSI Digital Signal Processing systems, Design and implementation", Wiley, Inter Science, 1999.
2. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw-Hill, 1994.
3. S.Y. Kung, H.J.White House,T.Kailath,"VLSI and Modern Signal Processing ", Prentice Hall,1985.

OUTCOMES:

On completion of the course, students will be able to

- Understand various algorithms that can be designed and applied on application specific VLSI architecture.
- Have knowledge on fast convolution algorithms and high speed multipliers.
- Gain minimum knowledge to find solution for any research queries on DSP processors.
- Apply the advantages retiming, unfolding and folding on pipelined and parallel processed architectures.
- Have the ability to develop advanced DSP filters and processors.
- Be able to develop optimized DSP designs by employing the advantages of VLSI concepts.

CSBX52	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn soft computing algorithms.
- To introduce new ideas of neural networks, fuzzy logic and use of heuristics based on human experience.
- To understand the concepts of Genetic algorithm and its applications.

MODULE I NEURAL NETWORK 7

Introduction - Machine Learning Basics - Fundamental concept - Evolution of Neural Networks - Basic Models of Artificial Neural Networks - Important Terminologies of ANNs - McCulloch-Pitts Neuron - Supervised Learning Network:- Multiple Adaptive Linear Neurons - Back-Propagation Network - Radial Basis Function Network.

MODULE II ARTIFICIAL NEURAL NETWORK- II 7

Associative Memory Networks: Training Algorithms for Pattern Association - Auto associative Memory Network - Hetero associative Memory Network - Bidirectional Associative Memory - Hopfield Networks - Iterative Auto associative Memory Networks - Temporal Associative Memory Network. Unsupervised Learning Networks: Fixed weight Competitive Nets - Kohonen Self-Organizing Feature Maps - Learning Vector Quantization - Counter propagation Networks-Adaptive Resonance Theory Networks - Special Networks.

MODULE III FUZZY SET THEORY - I 7

Introduction to Classical Sets and Fuzzy sets - Classical Relations and Fuzzy Relations - Tolerance and Equivalence Relations -Membership Functions: Fuzzification - Methods of Membership Value Assignments - Defuzzification - Lambda-Cuts for Fuzzy sets and Fuzzy Relations - Defuzzification Methods.

MODULE IV FUZZY SET THEORY - II 7

Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning: Truth values and Tables in Fuzzy logic - Fuzzy Propositions - Formation of Rules - Decomposition and Aggregation of rules - Fuzzy Reasoning - Fuzzy Inference Systems (FIS) - Fuzzy Decision Making - Fuzzy Logic Control Systems.

MODULE V GENETIC ALGORITHM 8

Introduction - Basic Operators and Terminologies in GAs - Traditional Algorithm vs. Genetic Algorithm - Simple GA - General Genetic Algorithm - The Scheme Theorem - Classification of Genetic Algorithm - Holland Classifier Systems - Genetic Programming.

MODULE VI APPLICATIONS OF SOFT COMPUTING 9

A Fusion Approach of Multispectral Images with SAR Image for Flood Area Analysis - Optimization of Travelling Salesman Problem using Genetic Algorithm Approach - Genetic Algorithm based Internet Search Technique - Soft Computing based Hybrid Fuzzy Controllers - Soft Computing based Rocket Engine - Control.

TOTAL HOURS : 45

REFERENCES

1. S.N. Sivanandan and S.N. Deepa, "Principles of Soft Computing", Wiley India, 2007.
2. S.N.Sivanandam, S.Sumathi and S.N.Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.
3. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004.
5. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", 2nd Edition, Pearson Publications, 2003.

OUTCOMES:

On completion of the course, students will be able to

- Identify and relate different types of neural networks
- Summarize and categorize the various soft computing algorithms.
- Devise the principles of soft computing in an application.
- Choose an algorithm for optimization purposes.
- Design a fuzzy application for given membership function and set of rules.
- Apply and interpret the soft computing algorithms in an application.

GENERAL ELECTIVES

GEBX107	VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

This course teaches:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers, State diagram, State Reduction and State Assignments.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements, Control-FSM, Control Logic Implementation. Programmable logic elements and AND-OR arrays, FPGAs and CPLD, programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters, Differential Inverter, Tri State Inverter, BiCMOS logic.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers,pass transistor circuits, Transmission Gate, Dynamic CMOS circuit techniques

TOTAL HOURS : 45

REFERENCES

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003
2. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
3. J.Bhasker: Verilog HDL primer, BS publication, 2001.
4. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
5. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
6. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

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

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GEBX208	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW

Introduction –Embedded Systems vs. General computing systems- Fundamental components of embedded systems- Characteristics - Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes – Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model-Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

TOTAL HOURS : 45

Text Books:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.

3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint, Tata McGraw-Hill, 2003

4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES

1. Sriram V Iyer and PankajGupta ,"Embedded Realtime Systems Programming "Tata McGraw-Hill,2008

2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003

3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.