AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE | Accredited by NAAC | Affiliated to JNTUA)

Gudur, Nellore Dist - 524101, A.P (India)

OUTCOME BASED EDUCATION

WITH

CHOICE BASED CREDIT SYSTEM

BACHELOR OF TECHNOLOGY

ACADEMIC REGULATIONS

UNDER AUTONOMOUS STATUS

DEPARTMENT OF

ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech Regular Four Year Degree Programme

(For the batches admitted from the academic year 2016 - 2017)

B.Tech (Lateral Entry Admission)

(For the batches admitted from the academic year 2017 - 2018)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS

IS NOT AN EXCUSE

One best book is equal to hundred good friends, but one good friend is equal to a library.

All of us do not have equal talent, but all of us have an equal opportunity to develop our talents

“This is the way to success”

Dr.A.P.J.Abdul Kalam

VISION AND MISSION OF THE INSTITUTE

VISION

To make Audisankara College of Engineering & Technology a centre for academic excellence where 21st century innovative minds manage with novel ideas & spreadout new technologies relevant to the social needs with increased employment opportunities and changed lifestyle.

MISSION

To provide the students with technological direction and support, acclaimed in latest cutting edge technologies with a blend of academic concepts and practical nuances in hot areas of engineering and technology so that they develop all the resourcefulness, competence and confidence to takeon the technological challenges of tomorrow.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: It's a privilege conferred to an institute by UGC following meticulous evaluation process to manage its academic programmes independently for promoting excellence.

Academic Year: An academic year consists of two semesters each lasting 21 weeks i.e., (one odd + one even). It is the period necessary to complete an actual course of study within a year.

AICTE: All India Council for Technical Education, New Delhi.

Autonomous Institute: An institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Ananthapuramu) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has not cleared and due to which obtained a failure grade (F) in that course.

Basic Sciences: Basic sciences are Mathematics, Physics, Chemistry, English etc., They provide the basic knowledge of all Engineering sciences.

Betterment: Betterment is a way that contributes towards improvement of the student's grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BoS): BoS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible to update and design curricula in respect of all the programs offered by the department.

Branch: It's specialization in an Engineering discipline like Electronics & Communication Engineering, Computer Science & Engineering, Electical & Electronics Engineering, Mechanical Engineering, Civil Engineering etc.

Certificate Course: It is a course that makes a student gain hands-on expertise and skills required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory Course: Course required to be undertaken for the award of the degree as per the program.

UGC: University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It's an examination that evaluates a student's progress throughout the prescribed course.

Course: A course is a unit of teaching that typically lasts one academic term. Courses explore the practice of teaching from both applied and theoretical perspective.

Course Outcomes: Learning outcomes are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course or program.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit Point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed upto two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: Standardized measurements of achievement in a course. It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

ASCET: AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY, Gudur, Nellore Dist, Andhra Pradesh.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Bachelor of Technology (B.Tech) degree program / PG degree program: Master of Technology (M.Tech)/ Master of Business Administration (MBA) / Master of Computer Applications (MCA).

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project Work: It is a design or research based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all B.Tech programs offered by Institute are designated as "ASCET Regulations R-16" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd Semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: A written representation of 'he or she' used as a neutral alternative to indicate someone of either sex.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

JNTUA: Means the Jawaharlal Nehru Technological University Anantapur, Ananthapuramu.

FOREWORD

The autonomy is conferred to **AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY(ASCET),** Gudur, Nellore Dist, Andhra Pradesh by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Anantapur (JNTUA), Ananthapuramu and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a followup, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUA to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time with Principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

Gudur, Nellore Dist - 524101, A.P (India)

ACADEMIC REGULATIONS

B.Tech. Regular Four Year Degree Programme

(For the batches admitted from the academic year 2016 - 17)

&

B.Tech. (Lateral Entry Scheme)

(For the batches admitted from the academic year 2017 - 18)

For pursuing four year undergraduate Bachelor Degree programme of study in Engineering (B.Tech) offered by AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY under Autonomous status and herein after referred to as ASCET.

1.0 CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching-learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / comprehensive examination / seminars / assignments / alternative assessment tools / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

- Choose electives from a wide range of elective courses offered by the departments.
- Undergo additional courses of interest.
- Adopt an interdisciplinary approach in learning.
- Make the best use of expertise of the available faculty.

2.0 ELIGIBILITY FOR ADMISSION

The total seats available as per the approved intake are grouped into two categories viz. category A and category B with a ratio of 70:30 as per the state government guidelines.

2.1 The admissions for category A and B seats shall be as per the guidelines of Andhra Pradesh State Council for Higher Education (APSCHE) in consonance with government reservation policy.

- Under category A: 70% of the seats are filled through EAMCET counseling.
- Under category B: 30% seats are filled based on 10+2 merits in compliance with guidelines of APSCHE.

2.2 Admission eligibility-Under Lateral Entry Scheme Students with diploma qualification have an option of direct admission into 2nd year B. Tech. (Lateral entry scheme). Under this scheme 10% seats of sanctioned intake will be available in each course as supernumerary seats. Admissions to this three year B Tech later entry programme will be through ECET. The maximum period to complete B. Tech. under lateral entry scheme is six consecutive academic years from the date of joining.

3.0. DURATION OF PROGRAMME

The course duration for the award of the Degree in **Bachelor of Technology** will be four academic years, with two semesters in each year. However if a student is unable to complete the course within 4 years, he/ she can do so by giving more attempts but within 8 consecutive academic years from the date of admission.

Academic Calendar

For all the eight semesters a common academic calendar shall be followed in each semester by having sixteen weeks of instruction, one week for the conduct of practical exams and with three weeks for theory examinations and evaluation. Dates for registration, sessional and end semester examinations shall be notified in the academic calendar of every semester. The schedule for the conduct of all the curricular and co-curricular activities shall be notified in the planner.

4.0.MEDIUM OF INSTRCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

5.0 BRANCHES OF STUDY

- Civil Engineering (CE)
- Electrical & Electronics Engineering (EEE)
- Mechanical Engineering (ME)
- Electronics & Communication Engineering (ECE)
- Computer Science & Engineering (CSE)

6.0 TYPES OF COURSES

6.1 Foundation / Skill Course

Foundation courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all. They are fundamentals to learn any subject.

6.2 Core Course

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

6.3 Elective Course

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from an unrelated discipline called as "Open Elective".

There are four professional elective groups; students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor/mentor. Nevertheless, one course from each of the two open electives has to be selected.

7.0 SEMESTER STRUCTURE

Each academic year is divided into two semesters, TWO being Main Semesters (one odd + one even). Main Semesters are for regular class work. However, the following cases are exempted:

7.1 Students admitted on transfer from JNTUA affiliated institutes, Universities and other institutes in the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned 'Board of Studies'.

7.2 Each main semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation and conduct of examinations.

7.3 Each main semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical are 75 and 15 days for conduct of exams and preparation.

7.4 The academic calendar shown in Table 1 is declared at the beginning of the academic year.

Table 1: Academic Calendar

FIRST SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation and Practical Examinations	1 week	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Examinations			2 weeks
SECOND SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation & Practical Examinations	1 week	
	Semester End Examinations		2 weeks
Summer Vacation and Supplementary Examinations			8 weeks

8.0 REGISTRATION

8.1 Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely compulsory for the student to register for courses intime. The registration will be organized departmentally under the supervision of the Head of the Department.

8.2 INABSENTIA registration will not be permitted under any circumstance.

8.3 At the time of registration, students should have cleared all the dues of Institute and Hostel in the previous semesters, paid the prescribed fees for the current semester and not been debarred from institute for a specified period on disciplinary or any other ground.

9.0 UNIQUE COURSE IDENTIFICATION CODE

Every course of the B.Tech program will be placed in one of the four groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

S. No	Branch	Code
1	Civil Engineering	01
2	Electrical & Electronics Engineering	02
3	Mechanical Engineering	03
4	Electronics & Communication Engineering	04
5	Computer Science & Engineering	05

10.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Foundation/ Skill Courses, Core Courses, Elective Courses, Open Electives, Laboratory Courses, Technical Seminar, Term Paper, Communication Skills Practice, Soft Skills Practice, Professional Society Activities, Mini Project, Internship and Major Project and Comprehensive Viva-Voce. The list of elective courses may include subjects from allied disciplines also.

Contact Periods: Depending on the complexity and volume of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits based on the number of hours/week as follows:

- Contact Classes (Theory): 1credit per lecture hour per week.
- Tutorial Classes (Theory): 1credit per 2 lecture hours per week.
- Laboratory Hours (Practical): 1 credit for 2 practical hours.

10.1Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Theory Course (Core/Foundation/Elective)	3	3
2	Theory Course (Core/Foundation/Elective)	2+2	3
3	MOOC Courses	-	3
4	Laboratory Courses/Drawing Courses	3	2
5	Technical Seminar	3	1
6	Term Paper	3	2
7	Mini Project	3	2
8	Internship	3	2
9	Major Project And Comprehensive Viva-Voce	8	12
10	Communication Skills Practice	3	1
11	Soft Skills Practice	3	1
12	Quantitative Aptitude	3	1
13	Technical Aptitude	3	1
14	Professional Society Activities	3	1
15	Full Semester Internship	-	21
16	Audit Course	-	-

10.2 Course Structure

Every program of study shall be designed to have 42 theory courses and 21 laboratory courses. Every course of the B.Tech program will be placed in one of the eight categories with minimum credits as listed in Table 4. In addition, a student has to carry out a mini project, project work and comprehensive examination.

Table 4: Category Wise Distribution of Credits

S. No	Category	Subject Area and % of Credits	Average No. of Credits
1	Humanities and Social Sciences (HS), including Management.	HS (05% to 10%)	**13**
2	Basic Sciences (BS) including Mathematics, Physics and Chemistry.	BS (10% to 15%)	**22**
3	Engineering Sciences (ES), including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	ES (10% to 15%)	**18**
4	Professional Subjects - Core (PC), relevant to the chosen specialization/branch.	PC (40% to 50%)	**99**
5	Professional Subjects - Electives (PE), relevant to the chosen specialization/branch.	PE (10% to 15%)	**15**
6	Open Subjects - Electives (OE), from other technical and/or emerging subject areas.	OE (01% to 5%)	**03**
7	Project Work and Comprehensive Viva-Voce, Mini Project and Internship	10% to 15%	**16**
8	Technical Seminar, Term Paper, Quantitative Aptitude, Technical Aptitude and Professional Society Activities	CRT	**10**
		TOTAL	**196**

10.3 Semester-wise course break-up

Following are the TWO models of course structure out of which any student shall choose or will be allotted with one model based on their academic performance.

i. Full Semester Internship (FSI) Model and

ii. Non Full Semester Internship (NFSI) Model.

10.4 Four year regular program (FSI Model):

In the FSI Model, selected/eligible students shall undergo Full Semester Internship in B.Tech 7^{th} Semester. In the Non FSI Model, the remaining students shall carry out the course work and project work as specified in the course structure. A student who secures a minimum CGPA of 7.5 upto 4^{th}

Semester with no backlogs and maintains the CGPA of 7.5 till 6th Semester shall be eligible to opt for FSI

10.5 For Four year regular program (FSI Model):

Year/Sem	No. of Theory Courses	No. of Lab Courses	Total Credits
1st Semester	5 Foundation	3	21
2nd Semester	5 Foundation	3	21
3rd Semester	1 Foundation + 5 Core	3+CSP+PSA+Audit Course	24+1+1=26
4th Semester	1 Foundation + 5 Core	3+TS+SSP+PSA	24+1+1+1=27
5th Semester	6 Core	3+TP+QA+PSA	24+2+1+1=28
6th Semester	5 Core + 1 Elective	3+Mini Project +TA+PSA	24+2+1+1=28
7th Semester	3 Core + 1 Elective + 1 Open Elective	3+Internship+PSA	21+2+1=24
8th Semester	Full Semester Internship (FSI)		21
Total	39	21+TP+TS+Internship+ Mini Project+ CSP+ SSP+ QA+TA+PSA+FSI	196

10.6 For Four year regular programme (Non FSI Model)

Year/Sem	No. of Theory Courses	No. of Lab Courses	Total Credits
1st Semester	5 Foundation	3	21
2nd Semester	5 Foundation	3	21
3rd Semester	1 Foundation + 5 Core	3+CSP+PSA+Audit Course	24+1+1=26
4th Semester	1 Foundation + 5 Core	3+TS+SSP+PSA	24+1+1+1=27
5th Semester	6 Core	3+TP+QA+PSA	24+2+1+1=28
6th Semester	5 Core + 1 Elective	3+Mini Project +TA+PSA	24+2+1+1=28
7th Semester	3 Core + 1 Elective + 1 Open Elective	3+Internship+PSA	21+2+1=24
8th Semester	3 Electives	Major Project +Viva	9+12=21
Total	42	21+TP+TS+Internship+Mini Project + CSP + SSP + QA+TA + PSA+Major Project	196

10.7 For Three year lateral entry program (FSI Model):

Year/Sem	No. of Theory Courses	No. of Lab Courses	Total Credits
3rd Semester	1 Foundation + 5 Core	3+CSP+PSA+Audit Course	24+1+1=26
4th Semester	1 Foundation + 5 Core	3+TS+SSP+PSA	24+1+1+1=27
5th Semester	6 Core	3+TP+QA+PSA	24+2+1+1=28
6th Semester	5 Core + 1 Elective	3+Mini Project +TA+PSA	24+2+1+1=28
7th Semester	3 Core + 1 Elective + 1 Open Elective	3+Internship+PSA	21+2+1=24
8th Semester	Full Semester Internship (FSI)		21
Total	29	15+TP+TS+Internship+Mini Project+ CSP+ SSP +QA +TA +PSA + FSI	154

10.8 For Three year lateral entry program (Non FSI Model)

Year/Sem	No. of Theory Courses	No. of Lab Courses	Total Credits
3rd Semester	1 Foundation + 5 Core	3+CSP+PSA	24+1+1=26
4th Semester	1 Foundation + 5 Core	3+TS+SS+PSA	24+1+1+1=27
5th Semester	6 Core	3+TP+QA+PSA+Audit Course	24+2+1+1=28
6th Semester	5 Core + 1 Elective	3+Mini Project +TA+PSA	24+2+1+1=28
7th Semester	3 Core + 1 Elective + 1 Open Elective	3+Internship+PSA	21+2+1=24
8th Semester	3 Electives	Major Project +Viva	9+12=21
Total	32	15+TP+TS+Internship+Mini Project+ CSP +SSP + QA + TA +PSA + Major Project	154

Note: PSA - Professional Society Activities
CSP - Communication Skills Practice
SSP – Soft Skills Practice
TS – Technical Seminar
TP – Term Paper
QA – Quantitative Aptitude
TA - Technical Aptitude

10.9 Course-wise break-up for Four year Regular program (FSI Model):

Total Theory Courses - 39 (36 Foundation and Core + 2 Professional Electives + 1 Open Elective)	39 @ 3credits each	117
Laboratory Courses – 21	21 @ 2 credits each	42
Term Paper with self study report	1@ 2 credit	02
Mini Project with self study report	1 @ 2credits	02
Internship	1 @ 2credits	02
Technical Seminar	1 @ 1credit	01
Communication Skills Practice	1 @ 1credit	01
Soft Skills Practice	1 @ 1credit	01
Quantitative Aptitude	1 @ 1credit	01
Technical Aptitude	1 @ 1credit	01
Professional Society Activities	5 @ 1credit each	05
Full Semester Internship	1 @ 21credit	21
	TOTAL CREDITS	**196**

10.10 Course-wise break-up for Four year Regular program(Non FSI Model)

Total Theory Courses - 42 (36 Foundation and Core + 5 Professional Electives + 1 Open Elective)	42 @ 3credits each	126
Laboratory Courses – 21	21 @ 2 credits each	42
Term Paper with self study report	1@ 2 credit	02
Mini Project with self study report	1 @ 2credits	02
Internship	1 @ 2credits	02
Technical Seminar	1 @ 1credit	01
Communication Skills Practice	1 @ 1credit	01
Soft Skills Practice	1 @ 1credit	01
Quantitative Aptitude	1 @ 1credit	01
Technical Aptitude	1 @ 1credit	01
Professional Society Activities	5 @ 1credit each	05
Major Project and Comprehensive Viva-Voce	1 @ 12credits	12
TOTAL CREDITS		**196**

10.11Course-wise break-up for three year lateral entry program(FSI Model)

Total Theory Courses - 29 (26 Foundation and Core + 2 Professional Electives + 1 Open Elective)	29 @ 3credits each	87
Laboratory Courses – 15	15 @ 2 credits each	30
Term Paper with self study report	1@ 2 credit	02
Mini Project with self study report	1 @ 2credits	02
Internship	1 @ 2credits	02
Technical Seminar	1 @ 1credit	01
Communication Skills Practice	1 @ 1credit	01
Soft Skills Practice	1 @ 1credit	01
Quantitative Aptitude	1 @ 1credit	01
Technical Aptitude	1 @ 1credit	01
Professional Society Activities	5 @ 1credit each	05
Full Semester Internship	1 @ 21credit	21
	TOTAL CREDITS	**154**

10.12 Course-wise break-up for three year lateral entry program (Non FSI Model):

Total Theory Courses - 32 (26 Foundation and Core + 5 Professional Electives + 1 Open Elective)	32 @ 3credits each	96
Laboratory Courses – 15	15 @ 2 credits each	30
Term Paper with self study report	1@ 2 credit	02
Mini Project with self study report	1 @ 2credits	02
Internship	1 @ 2credits	02
Technical Seminar	1 @ 1credit	01
Communication Skills Practice	1 @ 1credit	01
Soft Skills Practice	1 @ 1credit	01
Quantitative Aptitude	1 @ 1credit	01
Technical Aptitude	1 @ 1credit	01
Professional Society Activities	5 @ 1credit each	05
Major Project and Comprehensive Viva-Voce	1 @ 12credits	12
TOTAL CREDITS		**154**

11.0 DIVISION OF MARKS FOR INTERNAL AND EXTERNAL ASSESSMENT

Name of the Course	Continuous Internal Assessment (CIA)	Semester End Examination (SEE)
Theory	40	60
Laboratory	25	50
Technical Seminar	100	-
Term Paper	-	50
Mini Project	25	50
Internship	25	50
Communication Skills Practice	25	25
Soft Skills Practice	-	25
Quantitative Aptitude	-	50
Technical Aptitude	-	50
Professional Society Activities	-	-
Major Project and Comprehensive Viva-Voce	40	160

12.0 EVALUATION METHODOLOGY

The performance of a student in each semester shall be evaluated through Continuous Internal Assessment (CIA) and / or an Semester End Examination (SEE) conducted semester wise.

12.1 Theory Course

The performance of a student in every theory course shall be evaluated for total of 100 marks each, of which the relative weightage for Continuous Internal Assessment and Semester End Examination shall be 40 marks and 60 marks respectively.

12.2 Practical Course

The performance of a student in every practical course shall be evaluated for total of 75 marks each, of which the relative weightage for Continuous Internal Assessment and Semester End Examination shall be 25 marks and 50 marks respectively.

12.3 Internal Evaluation for Theory Course

The total internal weightage for theory courses is 40 marks with the following distribution.

- 30 marks for Mid-Term Examination
- 10 marks for Assignment Test

While the first mid-term examination shall be conducted on the 50% of the syllabus (Unit-I & Unit-II), the second mid-term examination shall be conducted on the remaining 50% of the syllabus (Unit III & Unit-IV).

10 marks are allocated for assignment test (as specified by the subject teacher concerned). The first assignment should be conducted after completion of Unit-I for 5 marks and the second assignment should be conducted after completion of Unit-III for 5 marks. The final Assignment Test marks will be the addition of these two.

Two midterm examinations each for **30 marks** with the duration of 90 minutes each will be conducted for every theory course in a semester. The midterm examination marks shall be awarded giving a weightage of 80% in the midterm examination in which the student scores better performance and 20% in the remaining midterm examination.

The final mid-term marks obtain by the addition of these two (80% + 20%).

Example: If a student scores 23 marks and 24 marks in the first and second mid-term examinations respectively,

then Weighted Average Marks = 24 x 0.8 + 23 x 0.2 = 23.8,

rounded to 24 Marks.

Note: The marks of any fraction shall be rounded off to the next higher mark.

12.4 Pattern of the midterm examination question paper is as follows

- A total of two Sections (Section-I & Section-II)
- Section-I contains five two marks questions. Two questions from each unit and a student has to be answered all five questions ($5 \times 2 = 10$ Marks)
- Section-II contains four questions are to be designed taking two questions from each unit and a student has to be answered three questions. ($3 \times 10 = 30$ Marks)
- Then its converted to 30 marks.

Pattern of the Assignment Test is as follows

- Five assignment questions are given in advance, out of which two questions given by the concerned teacher has to be answered during the assignment test
- Sum of Assignment Tests marks is considered.

Note: A student who is absent for any Mid-Term Examination/ Assignment Test, for any reason whatsoever, shall be deemed to have scored zero marks in that Mid-Term Examination/ Assignment Test and no make-up test shall be conducted.

12.5 Internal Evaluation for Practical Course

For practical subjects there shall be a Continuous Internal Evaluation during the semester for 25 internal marks. Out of the 25 marks for internal evaluation, day-to-day assessment in the laboratory shall be evaluated for 10 marks and internal practical examination shall be evaluated for 15 marks conducted by the laboratory teacher concerned.

12.6 Internal Evaluation for Design/ Drawing Courses

For the subject having design and/or drawing, (such as engineering graphics, engineering drawing, machine drawing, production drawing and building drawing) the internal marks distribution shall be 10 marks for day-to-day performance and 20 marks for Mid-Term Examinations.

12.7 Internal Evaluation for Technical Seminar

There shall be a Technical seminar presentation in 4^{th} Semester. A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. (**Distribution of marks for 50:** 10 marks for report, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

12.8 Internal Evaluation for Communication Skills Practice

For communicational skills practice subject, there shall be a Continuous Internal Assessment during the semester for 25 internal marks. Out of the 25 marks for internal evaluation, day-to-day assessment in the laboratory shall be evaluated for 10 marks and internal practical examination shall be evaluated for 15 marks conducted by the laboratory teacher concerned.

12.9 Mini Project

The Mini Project shall be carried out during 6^{th} Semester along with other lab courses by having regular weekly slots. Students will take mini project batch-wise and the batches will be divided as per the guidelines issued. The topic of mini project should be so selected that the students are enabled to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of mini project could be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with specific outcome.

Mini Project report will be evaluated for 75 marks. 25 marks for internal evaluation and 50 marks for external evaluation.

Assessment will be done by the supervisor/guide for 25 marks based on the work and presentation/ execution of the mini project.

The remaining 50 marks is based on report, presentation, execution and viva-voce. Evaluation is done by a committee comprising the mini project supervisor, Head of the Department and external examiner appointed by the Principal from the panel of experts recommended by Chairman, BOS in consultation with Head of the Department.

12.10 Internal Evaluation for Internship

Internship course is 25 marks for continuous internal assessment and will be evaluated based on day-to-day assessment by concern industry.

12.11 Internal Evaluation for Major Project Work: 8th Semester

The major project shall be carried out during the 8th Semester in the **Non FSI Model** and shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for semester end evaluation. Major project will be taken up batch wise and batches will be divided as per the guidelines. The object of major project is to enable the student to extend further the investigative study takenup as the project in Mini project under the guidance of the supervisor/ guide from the department.

The assignment normally includes:

- Preparing an action plan for conducting the investigation including the team work.
- In depth study of the topic assigned.
- Review and finalization of the approach to the problem relating to the assigned topic.
- Final development of product/process, testing, results, conclusions and further direction.
- Preparing a paper for conference presentation/ publication in journal, if possible.
- Preparing a dissertation in the standard format for being evaluated by the department.
- Final presentation of the work done before the Project Review Committee (PRC).

Major Project is allocated 60 internal marks. Out of 60, 30 marks are allocated for the supervisor/guide and head of the department to be evaluated based on two seminars given by each student on the topic of the project. The other 30 marks shall be evaluated on the basis of his presentation on the work done on his project by the Departmental Committee comprising of Head of the Department, respective supervisor/ guide and two senior faculty of the department appointed by the Principal.

12.12 External Evaluation for Theory Course - Semester End Examination

The Semester End Examination in each theory subject shall be conducted for 3 hours duration at the end of the semester for 60 marks.

Pattern of the Semester End Examination question paper is as follows:

- A total of two Sections (Section-I & Section-II)
- Section-I contains six two mark questions. One question from each unit and a student has to be answered all the six questions compulsory ($6 \times 2 = 12$ Marks)
- Section-II contains eight questions are to be designed taking two questions from each unit (Unit Wise - Either or type) of the total four units. ($4 \times 12 = 48$ Marks)

A student has to secure not less than a minimum of 40% of marks (24 marks) exclusively at the Semester End Examinations in each of the theory subjects in which the candidate had appeared. However, the candidate shall have to secure a minimum of 40% of marks (40 marks) in both external and internal components put together to become eligible for passing in the subject.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

12.13 External Evaluation for Practical Course

Out of 50 marks **35** marks are allocated for experiment (procedure for conducting the experiment carries 15 marks & readings, calculation and

result-20) and **10** marks for viva-voce examination with **5** marks for the record.

Each Semester External Lab Examination shall be evaluated by an Internal Examiner along with an External Examiner appointed by the Principal.

A candidate shall be declared to have passed in individual lab course if he secures a minimum of 50% aggregate marks (38 marks) (Internal & Semester External Examination marks put together), subject to a minimum of 50% marks (25 marks) in the semester external examination.

12.14 External Evaluation for Communication Skills Practice

25 marks to be conducted after 10 weeks of training to assess the training outcomes. Semester End Evaluation shall be done for 25 marks by the skilled soft Skill Trainer nominated by the Principal.

A candidate shall be declared to have passed in individual lab course if he secures a minimum of 50% aggregate marks (25 marks) (Internal & Semester External Examination marks put together), subject to a minimum of 50% marks (13 marks) in the semester external examination.

12.15 External Evaluation for Soft Skills Practice

25 marks to be conducted after 10 weeks of training to assess the training outcomes. Semester End Evaluation shall be done for 25 marks by the skilled soft Skill Trainer nominated by the Principal.

A candidate shall be declared to have passed in individual lab course if he secures a minimum of 50% marks (13 marks) in the semester external examination.

12.16 External Evaluation for Quantitative Aptitude

The external examination will be conducted for 50 Marks with 1 credit, examination type is Multiple Choice Question (MCQ) – Offline/Online.

12.17 External Evaluation for Technical Aptitude

The external examination will be conducted for 50 Marks with 1 credit, examination type is Multiple Choice Question (MCQ) – Offline/Online.

12.18 External Evaluation for Term Paper

The Term Paper is a self study report and shall be carried out either during 5th Semester along with other lab courses. Every student will take up this

term paper individually and submit a report. The scope of the term paper could be an exhaustive literature review choosing any engineering concept with reference to standard research papers or an extension of the concept of earlier course work in consultation with the term paper supervisor. The term paper reports submitted by the individual students during the 5th Semester shall be evaluated for a total of 50 marks for external evaluation, it shall be conducted by two Examiners, one of them being term paper supervisor as internal examiner and an external examiner nominated by the Principal from the panel of experts recommended by HOD.

12.19 External Evaluation for Major Project

The major project shall be carried out during the 8th Semester in the **Non FSI Model** and shall be evaluated for 200 marks. The Semester End Examination for major project work done during 8th Semester and for 140 marks shall be conducted by a Project Review Committee (PRC). The committee comprises of an External Examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor. The evaluation of project work shall be conducted at the end of the 8th Semester. The above committee evaluates the project work report with weightages of 50% of the marks (50 marks) awarded by external examiner, 20% of marks (20 marks) awarded by HOD & 30% of the marks (30 marks) by Project Guide/ Supervisor respectively for a total of 100 marks. Of the 40 marks for Presentation & Viva-Voce examination, HOD evaluates for 10 marks and external examiner for 30 marks. The evaluation of 140 marks is distributed as given below:

Distribution of Project Work Marks

Sl. No.	Criterion	Marks
1	Report	100
2	Presentation & Viva – Voce	40

A candidate shall be declared to have passed in major project if he secures a minimum of 50% aggregate marks (100 marks) (Internal & Semester External Examination marks put together), subject to a minimum of 50% marks (70 marks) in the major project end examination.

12.20 Massive Open Online Courses (MOOCs)

Meeting with the global requirements, to inculcate the habit of self learning and incompliance with UGC guidelines, MOOC (Massive Open Online

Course) courses have been introduced as electives. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion for the course from the MOOCs providers

Regulations for MOOCs

- The respective departments shall give a list from NPTEL or any other standard providers, whose credentials are endorsed by the HOD.
- Each department shall appoint Coordinators/Mentors and allot the students to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same.
- A student shall choose an online course (relevant to his/her programme of study) from the given list of MOOCs providers, as endorsed by the teacher concerned, with the approval of the HOD.
- The details of MOOC(s) shall be displayed in Grade card of a student, provided he/she submits the proof of completion of it to the department concerned through the Coordinator/Mentor.
- Student can get certificate from SWAYAM/NPTEL or any other standard providers, whose credentials are endorsed by the HOD. The course work should not be less than 12 weeks or student may appear for end examination conducted by the Institute.
- There shall be one Mid Continuous Internal Examination (Quiz exam for 40 marks) after 9 weeks of the commencement of the course and semester end examination (Descriptive exam for 60 marks) shall be done along with the other regular courses.
- Three credits will be awarded upon successful completion of each MOOC courses having minimum of 8 weeks duration.

12.21 Internship

There shall be 60 hours duration to complete summer internship during summer vacations. The total internal weightage for internship course is 25 marks and will be evaluated based on day-to-day assessment by concern industry.

The external examination shall be evaluated by the two senior faculties (i.e one faculty act as external examiner and other one as internal examiner) for 50 marks based on the his/her report and presentation.

12.22 Full Semester Internship (FSI)

Full Semester Internship (FSI) programme carries 21 credits. During the FSI, student has to spend one full semester in an identified industry /firm / organization and has to carry out the internship as per the stipulated guidelines of that industry / firm / organization and the institute.

Following are the evaluation guidelines

- Profile and abstract –Student has to submit the industry profile and abstract of the project within four weeks from date of commencement of internship through mail or post.

  Weightage: 10%.

- Seminar 1 -at 9^{th} week from date of commencement of internship weightage: 10%
- Seminar 2 -Pre-submission at 17^{th} week from date of commencement of internship– Weightage: 10%
- Internship Diary, weightage: 15 %
- Project Report, weightage: 15%
- Viva-voce & Final Presentation, weightage: 40%

The internship shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for external evaluation.

The external evaluation based on the report submitted and viva-voce exam for 140 marks by a committee comprising the HOD, Project supervisor and external examiner (Industry/ Academia).A minimum of 60% of maximum marks shall be obtained to earn the corresponding credits.

FSI shall be open to all the branches in the VII semester. The selection procedure is:

- Choice of the students
- CGPA (> 7.5) upto IV semester with no current arrears and maintains the CGPA of 7.5 till VI Semester

13.0 GRADING PROCEDURE

Grades will be awarded to indicate the performance of students in each theory subject, laboratory / practicals, Technical Seminar, Term Paper, Mini Project, Communication Skills Practice, Soft Skills Practice, Quantitative Aptitude, Technical Aptitude and Major Project. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 11 above, a corresponding letter grade shall be given.

13.1 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	S (Superior)	10
80 and less than 90%	A (Excellent)	9
70 and less than 80%	B (Very Good)	8
60 and less than 70%	C (Good)	7
50 and less than 60%	D (Average)	6
40 and less than 50%	E (Pass)	5
Below 40%	F (FAIL)	0
Absent	AB	0

13.2 A student who has obtained an 'F' grade in any subject shall be deemed to have 'failed' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier

13.3 To a student who has not appeared for an examination in any subject, 'Ab' grade will be allocated in that subject, and he is deemed to have 'failed'. A student will be required to reappear as a 'supplementary

student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

13.4 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

13.5 A student earns grade point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'credit points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit points (CP) = grade point (GP) x credits …. For a course

13.6 A student passes the subject/ course only when GP 5 ('E' grade or above)

13.7 A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.

For Mandatory courses "Satisfactory? or "Unsatisfactory? shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

13.8 Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \sum(C_i \times G_i)/\sum C_i$$

where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \sum(C_i \times S_i)/\sum C_i$$

where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D, E and F.

Example: Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade Letter	Grade Point	Credit Point
Course-I	3	S	10	3x10=30
Course-II	3	A	9	3x9=27
Course-III	3	B	8	3x8=24
Course-IV	3	D	6	3x6=18
Course-V	2	B	8	2x8=16
Course-VI	1	C	7	1x7=7
	15			122

Thus, SGPA $= \frac{122}{15} = 8.13$

Illustration for CGPA

1st Semester	2nd Semester	3rd Semester	4th Semester
Credit: 21 SGPA: 8.13	Credit: 21 SGPA: 6.9	Credit: 26 SGPA: 7.3	Credit: 27 SGPA: 6.8
5th Semester	**6th Semester**	**7th Semester**	**8th Semester**
Credit: 28 SGPA: 8.2	Credit: 28 SGPA: 7.4	Credit: 24 SGPA: 7.2	Credit: 21 SGPA: 7.8

Thus, CGPA

$$\frac{(21\times 8.13)+(21\times 6.9)\times(26\times 7.3)+(27\times 6.8)+(28\times 8.2)(28\times 7.2)(24\times 7.2)(21\times 7.8)}{196}$$

$=7.432$

14.0 AWARD OF CLASS

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

CGPA ≥ 7.5	CGPA ≥ 6.5 and < 7.5	CGPA ≥ 5.0 and < 6.5	CGPA ≥ 4.0 and < 5.0	CGPA < 4.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

A student with final CGPA is < 4.00 will not be eligible for the Award of the Degree.

15.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

15.1 Semester end examination shall be conducted by the Controller of Examinations (CoE) by inviting Question Papers from the External Examiners

15.2 Question papers may be moderated for the coverage of syllabus, pattern of questions by a Semester End Examination Committee chaired by CoE and senior subject expert before the commencement of semester end examinations. Internal Examiner shall prepare a detailed scheme of valuation.

15.3 The answer papers of semester end examination should be evaluated by the first examiner immediately after the completion of exam and the award sheet should be submitted to CoE in a sealed cover before the same papers are kept for second evaluation by external examiner.

15.4 In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and the marks awarded by third examiner is compared with first and second evaluation marks and higher marks of minimum difference pair will be considered as final marks.

15.5 CoE shall invite required number of external examiners to evaluate all the end-semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

15.6 Examinations Control Committee shall consolidate the marks awarded by both the examiners and award grades.

16.0 SUPPLEMENTARY EXAMINATIONS

Apart from the regular End Examinations the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day.

17.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

17.1 A candidate shall putin a minimum required attendance of 75 % in that semester. Otherwise, s/he shall be declared detained and has to repeat semester.

17.2 For cases of medical issues, deficiency of attendance in a semester to the extent of 10% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the department if their attendance is between 75% and 65% in a semester, subjected to submission of medical certificates, medical case file and other needful documents to the concerned departments. The condonation is permitted maximum of two times during the entire course of study.

17.3 A prescribed fee shall be payable towards condonation of shortage of attendance.

17.4 A student shall not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he/she shall not be eligible for readmission into the same class.

17.5 Any student against whom any disciplinary action by the institute is pending shall not be permitted to attend any SEE in that semester.

18.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 17.

18.1 In four year B.Tech program, a student shall be promoted from 2nd year to 3rd year only if s/he fulfills the academic requirements and earning of minimum 50% of credits upto 2nd year.

18.2 In four year B.Tech program, a student shall be promoted from 3rd year to 4th year only if s/he fulfills the academic requirements and earning of minimum 50% credits upto 3rd year.

18.3 A student shall register for all the 196 credits and earn all the 196 credits. Marks obtained in all the 196 credits shall be considered for the award of the Grade.

18.4 In three year lateral entry B.Tech program, a student shall be promoted from 3rd year to 4th year only if s/he fulfills the academic requirements and earning of minimum 50% credits upto 3rd year.

18.5 In three year lateral entry, a student shall register for all the 154 credits and earn all the 154 credits. Marks obtained in all the 154 credits shall be considered for the award of the Grade.

19.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of the B.Tech degree.

19.1 Student shall register and acquire minimum attendance in all courses and secure 196 credits for regular program and 154 credits for lateral entry program.

19.2 A student of a regular program, who fails to earn 196 credits within eight consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

19.3 A student of a lateral entry program who fails to earn 154 credits within six consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

20.0 REVALUATION

A student, who seeks the re-evaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s), within 5 working days from the declaration of results in the prescribed format with prescribed fee to the Controller of Examinations through the Head of the department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

21.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

21.1 A candidate is normally not permitted to break the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the program after the break from the commencement of the respective semester as and when it is offered, s/he shall apply to the Principal in advance. Such application shall be submitted before the commencement of the semester in question and forwarded through the Head of the department stating the reasons for such withdrawal together with supporting documents and endorsement of his / her parent / guardian.

21.2 The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to rejoin. Such permission is accorded only to those who do not have any outstanding dues like tuition fee etc.

21.3 The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in clause 19.0. The maximum period includes the break period.

22.0 TERMINATION FROM THE PROGRAMME

The admission of a student to the program may be terminated and the student is asked to leave the institute in the following circumstances:

22.1 The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

22.2 A student shall not be permitted to study any semester more than three times during the entire Program of study.

22.3 The student fails to satisfy the norms of discipline specified by the institute from time to time.

23.0 WITH-HOLDING OF RESULTS

If the candidate has any dues not paid to the institute or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld and he/she will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

24.0 STUDENT TRANSFERS

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.

25.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute. The college shall institute prizes and medals to meritorious students and award them annually at the Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

26.0 CONDUCT AND DISCIPLINE

- Students shall conduct themselves within and outside the premises of the Institute in a descent and dignified manner befitting the students of Audisankara College of Engineering & Technology.
- As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offence and is totally banned. Any form of ragging will be severely dealt with the following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

(i) Lack of courtesy and decorum; indecent behavior anywhere within or outside the college campus.

(ii) Damage of college property or distribution of alcoholic drinks or any kind of narcotics to fellow students / citizens.

- Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
- Mutilation or unauthorized possession of library books.
- Noisy and unruly behavior, disturbing studies of fellow students.
- Hacking in computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber crime etc.
- Usage of camera /cell phones in the campus.
- Plagiarism of any nature.
- Any other act of gross indiscipline as decided by the college academic council from time to time.
- Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute/ hostel, debarring from examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.
- For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief Warden, the concern Head of the Department and the Principal respectively, shall have the authority to reprimand or impose fine.
- Cases of adoption of unfair means and/ or any malpractice in an examination shall be reported to the principal for taking appropriate corrective action.
- All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the Academic council of the college.
- The Institute Level Standing Disciplinary Action Committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

- The Principal shall deal with any problem, which is not covered under these rules and regulations.

27.0 GRIEVANCE REDRESSAL COMMITTEE

Grievance and Redressal Committee constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters. All the students must abide by the code and conduct rules prescribed by the college from time to time.

28.0 TRANSITORY REGULATIONS

Transitory regulations required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) s/he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

28.1 Four Year B.Tech Regular course

A student who is following Jawaharlal Nehru Technological University Anantapur (JNTUA) curriculum and detained due to shortage of attendance at the end of the first semester shall join the autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate

seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

28.2 Three Year B.Tech program under Lateral Entry Scheme

A student who is following JNTUA curriculum and detained due to shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

28.3 Transfer candidates (from non-autonomous college affiliated to JNTUA)

A student who is following JNTUA curriculum, transferred from other college to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in their place as decided by the Board of

Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

28.4 Transfer candidates (from an autonomous college affiliated to JNTUA)

A student who has secured the required credits upto previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

29.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

B.TECH - PROGRAM OUTCOMES (POS)

PO-1: Apply the knowledge of Mathematics, Science, Engineering fundamentals, and Engineering specialization to the solution of complex Engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: 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 **(Design/ Development of Solutions).**

PO-4: 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 **(Conduct Investigations of Complex Problems).**

PO-5: 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 **(Modern Tool Usage).**

PO-6: 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 **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: 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 **(Communication).**

PO-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.

PO-12: 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 **(Life-long learning).**

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2 Shall Audisankara College of Engineering & Technology award its own Degree?

No. Degree will be awarded by Jawaharlal Nehru Technological University Anantapur, Ananthapuramu with a mention of the name Audisankara College of Engineering & Technology on the Degree Certificate.

3 What is the difference between a Deemed to be University and an Autonomy College?

A Deemed to be University is fully autonomous to the extent of awarding its own Degree. A Deemed to be University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4 How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Andhra Pradesh mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5 What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic

performances, our capability of self- governance and the kind of quality education we offer.

6 Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a builtin mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7 Will the students of Audisankara College of Engineering & Technology as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No. Audisankara College of Engineering & Technology has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8 Can Audisankara College of Engineering & Technology have its own Convocation?

No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at Audisankara College of Engineering & Technology.

9 Can Audisankara College of Engineering & Technology give a provisional degree certificate?

Since the examinations are conducted by Audisankara College of Engineering & Technology and the results are also declared Audisankara College of Engineering & Technology, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior

permission of the University the college will be entitled to give the provisional certificate.

10 Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11 What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 60 % external and 40% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12 Is it possible to have complete Internal Assessment for Theory or Practicals?

Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13 Why Credit based Grade System?

The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14 What exactly is a Credit based Grade System?

The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like S,A+,A, B+,B,C,F etc. are assigned for a Range of Marks. (e.g. 90% and above is S, 80 to 89 % could be A+ etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades

are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15 What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?

These norms are usually defined by UGC or AICTE. Usually around 28 Credits per semester is the accepted norm.

16 What is a Semester Grade Point Average (SGPA)?

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17 What is a Cumulative Grade Point Average (CGPA)?

An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{m}\left(C_j S_j\right) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits upto the semester and *m*represent the number of semesters completed in which a student registered upto the semester. CGPA is rounded to two decimal places.

18 Is there any Software available for calculating Grade point averages and converting the same into Grades?

Yes, the institute has its own MIS software for calculation of SGPA, CGPA, etc.

19 Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20 Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a makeup Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21 How fast Syllabi can be and should be changed?

Autonomy allows us the freedom to change the syllabi as often as we need.

22 Will the Degree be awarded on the basis of only final year performance?

No. The CGPA will reflect the average performance of all the semester taken together.

23 What are Statutory Academic Bodies?

Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in every body is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24 Who takes Decisions on Academic matters?

The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25 What is the role of Examination committee?

The Examinations Committee is responsible for the smooth conduct of internal, End Semester and makeup Examinations. All matters involving the conduct of examinations spot valuations, tabulations preparation of Grade Cards etc, fall within the duties of the Examination Committee.

26 Is there any mechanism for Grievance Redressal?

The institute has grievance redressal committee, headed by Dean Student affairs and Dean - IQAC.

27 How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulation

28 Who declares the result?

The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29 Who will keep the Student Academic Records, University or Audisankara College of Engineering & Technology?

It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30 What is our relationship with the JNT University?

We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31 Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32 Shall we get autonomy for PG and Doctoral Programmes also?

Yes, presently our PG programmes also enjoying autonomous status..

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Course Structure for

B.Tech (Electronics &Communication Engineering)

Regular Programme

Applicable for students admitted from 2016-17 Academic Year

B.Tech 1st Semester – Electronics & Communication Engineering

S.No	Code	Course	L	T	P	Drg	C
1	16HS1101	Professional English-I	3	0	0	0	3
2	16HS1102	Calculus and Differential Equations	3	1	0	0	3
3	16HS1104	Applied Chemistry	3	1	0	0	3
4	16ME1102	Basic Mechanical and Civil Engineering	3	1	0	0	3
5	16CS1101	Computer Programming	3	0	0	0	3
6	16HS2108	Applied Chemistry Lab	0	0	3	0	2
7	16CS2102	Computer Programming Lab	0	0	3	0	2
8	16ME2103	Engineering Drawing Practice	0	0	0	3	2
	TOTAL		**15**	**3**	**6**	**3**	**21**

B.Tech 2nd Semester –Electronics & Communication Engineering

S.No	Code	Course	L	T	P	Drg	C
1	16HS1201	Professional English-II	3	0	0	0	3
2	16HS1202	Integral Transformations	3	1	0	0	3
3	16HS1103	Applied Physics	3	1	0	0	3
4	16HS1105	Environmental Studies	3	0	0	0	3
5	16EE1202	Circuit Theory	3	1	0	0	3
6	16HS2106	Professional English Lab	0	0	3	0	2
7	16HS2107	Applied Physics Lab	0	0	3	0	2
8	16ME2104	Engineering Workshop and IT Workshop	0	0	3	0	2
	TOTAL		**15**	**3**	**9**	**0**	**21**

B.Tech 3rd Semester – Electronics & Communication Engineering

S.No	Code	Course	L	T	P	Oth	C
1	16HS1301	Complex Analysis	3	1	0	0	3
2	16EC1301	Electronic Devices and Circuits	3	1	0	0	3
3	16CS1305	Introduction to Data Structures	3	0	0	0	3
4	16EE1301	Electromagnetic Fields	3	1	0	0	3
5	16EE1302	Network Analysis	3	1	0	0	3
6	16EE1303	DC Machines	3	0	0	0	3
7	16EC2305	Electronic Devices and Circuits Lab	0	0	3	0	2
8	16EE2305	Electrical Circuits Lab	0	0	3	0	2
9	16EE2306	Electrical Workshop	0	0	3	0	2
10	16AS3301	Communication Skills Practice	0	0	0	3	1
11	16AS3302	Professional Society Activities-I	0	0	0	3	1
12		Audit Course					
	TOTAL		**18**	**4**	**9**	**6**	**26**

B.Tech 4th Semester – Electronics & Communication Engineering

S.No	Code	Course	L	T	P	Oth	C
1	16HS1401	Matrices and Numerical Methods	3	1	0	0	3
2	16CS1407	Data Structures through C	3	0	0	0	3
3	16EC1401	Analog Circuit Analysis	3	1	0	0	3
4	16EC1402	Pulse and Digital Circuits	3	1	0	0	3
5	16EC1403	Electromagnetic Theory and Transmission Lines	3	1	0	0	3
6	16EC1404	Computer Architecture and Organization	3	0	0	0	3
7	16CS2411	Data Structures through C Lab	0	0	3	0	2
8	16EC2407	Analog Circuit Analysis Lab	0	0	3	0	2
9	16EC2408	Pulse and Digital Circuits Lab	0	0	3	0	2
10	16AS3401	Technical Seminar	0	0	0	3	1
11	16AS3402	Soft Skills Practice	0	0	0	3	1
12	16AS3403	Professional Society Activities-II	0	0	0	3	1
	TOTAL		**18**	**4**	**9**	**9**	**27**

B.Tech 5th Semester – Electronics & Communication Engineering

S.No	Code	Course	L	T	P	Oth	C
1	16CS1506	OOPs through JAVA	3	0	0	0	3
2	16EC1501	Linear Integrated Circuits and Applications	3	1	0	0	3
3	16EC1502	Digital IC System Design	3	1	0	0	3
4	16EC1503	Linear Control Systems	3	1	0	0	3
5	16EC1504	Analog Communications	3	0	0	0	3
6	16EC1505	Antennas and Wave Propagation	3	1	0	0	3
7	16CS2409	OOPs through JAVA Lab	0	0	3	0	2
8	16EC2506	Linear IC Applications Lab	0	0	3	0	2
9	16EC2507	Digital IC System Design Lab	0	0	3	0	2
10	16AS3501	Term Paper	0	0	0	3	2
11	16AS3502	Quantitative Aptitude	0	0	0	3	1
12	16AS3503	Professional Activities-III	0	0	0	3	1
	TOTAL		**18**	**4**	**9**	**9**	**28**

B.Tech 6th Semester – Electronics & Communication Engineering

S.No	Code	Course	L	T	P	Oth	C
1	16EC1601	VLSI Design	3	1	0	0	3
2	16EC1602	Electronic Measurements and Instrumentation	3	0	0	0	3
3	16EC1603	Digital Communications	3	1	0	0	3
4	16EC1604	Microprocessors and Microcontrollers	3	1	0	0	3
5	16EC1605	Digital Signal Processing	3	1	0	0	3
6	**ELECTIVE-I**						
	16EC1606	Digital Television	3	0	0	0	3
	16EC1607	Computer Networks					
	16EC1608	Telecommunication Switching Techniques					
	16EC1609	Available Selected MOOCs					
7	16EC2611	VLSI Design Lab	0	0	3	0	2
8	16EC2612	Analog and Digital Communication Lab	0	0	3	0	2
9	16EC2613	Microprocessors and Microcontrollers Lab	0	0	3	0	2
10	16EC2615	Mini Project	0	0	0	3	2
11	16AS3601	Technical Aptitude	0	0	0	3	1
12	16AS3602	Professional Society Activities-IV	0	0	0	3	1
	TOTAL		**18**	**4**	**9**	**9**	**28**

B.Tech 7th Semester – Electronics & Communication Engineering

S.No	Code	Course	L	T	P	Oth	C
1	16MB1411	Engineering Economics and Project Management	3	0	0	0	3
2	16EC1701	Microwave Engineering	3	1	0	0	3
3	16EC1702	Embedded Systems	3	1	0	0	3
4	**ELECTIVE-II (OPEN ELECTIVE)**		3	1	0	0	3
5	**ELECTIVE-III**						
	16EC1703	DSP Processors and Architectures	3	1	0	0	3
	16EC1704	Wireless Communications and Networks					
	16EC1705	Optical Communications					
	16EC1706	Available Selected MOOCs					
6	16EC2709	Microwave Engineering Lab	0	0	3	0	2
7	16EC2710	Instrumentation and Measurements Lab	0	0	3	0	2
8	16EC2711	DSP and Embedded Systems Lab	0	0	3	0	2
9	16AS3701	Internship	0	0	0	3	2
10	16AS3702	Professional Society Activities-V	0	0	0	3	1
	TOTAL		**15**	**4**	**9**	**6**	**24**

B.Tech 8th Semester – Electronics & Communication Engineering

S.No	Code	Course	L	T	P	Oth	C
1	**ELECTIVE-IV**						
	16EC1801	Cellular and Mobile Communication	3	1	0	0	3
	16EC1802	Radar Engineering					
	16EC1803	ASIC Design					
	16EC1804	Neural Network and Fuzzy Logic					
2	**ELECTIVE-V**						
	16EC1805	Satellite Communications	3	1	0	0	3
	16EC1806	Digital Design through HDL					
	16EC1807	Micro Electro Mechanical Systems					
	16EC1808	Available Selected MOOCs					
3	**ELECTIVE-VI**						
	16EC1809	Data Communications	3	1	0	0	3
	16EC1810	RFID Technology					
	16EC1811	Virtual Instrumentation					
	16EC1812	Available Selected MOOCs					
4	16EC2814	Major Project and Comprehensive Viva-Voce	0	0	8	0	12
	TOTAL		**9**	**3**	**8**	**0**	**21**

ELECTIVE-II (OPEN ELECTIVE)

S.No	Code	Course
1	16CE1707	Disaster Management
2	16CE1708	Infrastructure Systems Planning
3	16EE1707	Renewable Energy Sources
4	16EE1708	Energy Auditing
5	16ME1708	Industrial Robotics
6	16ME1709	Nano Material Applications
7	16EC1707	Digital Image Processing
8	16EC1708	Electronic Product Design and Packaging
9	16EC1709	Bio-Medical Instrumentation
10	16CS1708	Internet of Things
11	16CS1709	Python Programming Language
12	16MB1302	Entrepreneurship Development

OOPS THROUGH JAVA

B.Tech 5th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16CS1506	Core	3	-	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism

II. Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collection

III. How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.

UNIT-I	INTRODUCTION	Classes:15

Introduction: Differences between C and java, Features of java, datatypes, variables, arrays, operators, control statements, simple Java program, Input and output in java.

Introducing OOP: Problems in procedural oriented programming, Features of oop, Classes and objects creation, Constructors, Methods, static keyword, this keyword, passing & returning objects from methods, Recursion, Using String class methods, Command line arguments.

UNIT-II	INHERITANCE	Classes:15

Inheritance: Inheritance basics, Using super, Access specifiers, Types of inheritances, method overriding.

Abstract, Final & Interfaces: Abstract class & methods, Final class & Methods, Interfaces.

Packages: Package creation, Access Protection, Importing Packages.

The Applet Class: Applet basics, Simple applet creation.

UNIT-III	EXCEPTION HANDLING	Classes:15

Exception Handling : Exception Handling Fundamentals, Handling exceptions with try, catch, finally, throw & throws clause, Types of exceptions.

Multithreading: Uses of threads, creating & Running Threads, Thread life cycle.

UNIT-IV		Classes:15

Graphics programming using AWT: AWT, Event Delegation Model, Listeners & Listener Methods, Creating Frames, Check boxes, Radio buttons, TextField, TextArea, Label, Choice, List, Scrollbar, Handling mouse & keyboard events.

Layout Managers: Flow Layout, Border Layout, Card Layout, Grid Layout, Box Layout.

Text Books

1. Herbert Schildt, The Complete Reference Java J2SE 7th Edition, TMH Publishing Company Ltd, NewDelhi.
2. H.M.Dietel and P.J.Dietel, Java How to Program, Sixth Edition, Pearson Education/PHI.

Reference Books

1. Cay.S.Horstmann and Gary Cornell, Core Java 2, Vol 1, Fundamentals, Seventh Edition, Pearson Education.
2. R. Nageswara Rao, Core Java, An Integrated Approach, First Edition, DreamTech press

Web References

1. https://beginnersbook.com/2013/04/oops-concepts/
2. https://www.journaldev.com/12496/oops-concepts-java-example

E-Text Books

1. *https://zodml.org/sites/default/files/Object_Oriented Programming_ using_Java_0.pdf*
2. https://bookboon.com/en/object-oriented-programming-using-java-ebook

Outcomes

1. Solve problems using object oriented approach and implement them using Java.
2. Keep the related class of code together to create a package and im port the same for future application development.
3. Implement multiple inheritances using interface concept.
4. Handle runtime errors through exception handling mechanism.
5. Explore concepts of concurrent programming by using multi thread ing.
6. Create user friendly interface using Applets, Event handlers and swings

LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

B.Tech 5th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1501	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To understand the basic concepts of operational amplifier and its various applications.

II. To understand the basics of PLL and its practical applications.

III. To know about various analog switches and different A/D and D/A convertors.

UNIT-I	INTEGRATED CIRCUITS	Classes:15

Integrated Circuits: Differential amplifier –DC and AC analysis of Dual input balanced outputconfiguration, Properties of other differential amplifier configuration (dual input unbalanced output, single ended input-balanced/unbalanced output), DC coupling and cascade differential amplifier stages, Level Translator.

Characteristics of OP-Amps, integrated circuits-types, classification, package types and temperature ranges, power supplies, OP-Amp Block diagram, ideal and practical OP-Amp specifications, DC and AC characteristics, 741 OP-Amp and its features, FET input OP-Amps, OP-Amp parameters and measurement, input and output offset voltages and currents, slew rate, CMRR, PSRR, drift, Frequency compensation technique.

UNIT-II	LINEAR AND NON LINEAR APPLICATIONS OF OP-AMPS	Classes:15

Linear Applications of OP-AMPS: Inverting and non-inverting amplifier, integrator and differentiator,difference amplifier, instrumentation amplifier, AC amplifier, V-I, I-V converters, Buffers.

Non Linear Applications of OP-AMPS: Non-linear function generation, comparators, Multivibrators,Triangular and square wave generators, Log and antilog amplifiers, precision rectifiers.

UNIT-III	ANALOG FILTERS, TIMERS AND PHASE LOCKED LOOPS	Classes:15

Analog Filters: Introduction, Butterworth filters-first order, second order LPF, HPF filters. Band pass, Band reject and all pass filters.

Timers and Phase Locked Loops: Introduction to 555 Timer, functional diagram, Monostable andAstable operations and applications, Schmitt Trigger, PLL-Introduction, Block schematic, principles and description of individual blocks,565 PLL ,applications of PLL-Frequency multiplication, frequency translation, AM, FM and FSK demodulators.

UNIT-IV	D/A AND A/D CONVERTERS	Classes:15

D/AAND A/D Converters: Introduction, Basic DAC techniques, weighted resistor DAC, R-2R LadderDAC, Inverted R-2R DAC and IC 1408 DAC, different types of ADCs-parallel comparator type ADC, counter type ADC, successive approximation ADC and Dual slope ADC.DAC and ADC specifications, specifications AD 574 (12 bit ADC).

Analog Multipliers and Modulators: Four quadrant multiplier, Balanced modulator, IC 1496,applications of analog switches and multiplexers, sample and hold amplifiers, Voltage regulator (IC based).

Text Books

1. Op-Amps & Linear ICs, Ramakanth A. Gayakwad, 4th edition, PHI, 2000.
2. Operational Amplifiers & Linear Integrated Circuits–R.F.Coughlin & Fredrick Driscoll, 6th edition, PHI, 2000.

Reference Books

1. Operational Amplifiers & Linear ICs by David A. Bell, 2nd edition, Oxford University Press, 2010.
2. Linear Integrated Circuits – D. Roy Chowdhary, New Age International (p) Ltd, 2nd Edition, 2003.

Web References

1. https://books.google.co.in/books/about/Linear_ Integrated _ Circuits.html? id=aByz—9D63wC
2. https://www.oreilly.com/library/view/linear-integrated-circuit 9789332558250/

E-Text Books

1. https://easyengineering.net/linear-integrated-circuits-books/
2. https://www.sanfoundry.com/best-reference-books-op-amps-linear-ics

Outcomes

1. Know the basic building blocks of linear integrated circuits.
2. Learn the linear and non-linear applications of operational amplifiers
3. Learn the theory and applications of analog multipliers and PLL.
4. learn the theory of ADC and DAC
5. construct a few special function integrated circuits
6. Understand analog multipliers and modulators using IC's

DIGITAL IC SYSTEM DESIGN

B.Tech 5th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1502	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: - 10		Practical Classes: Nil			Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To study basic semiconductor principles and digital IC technology, static and dynamic characteristics of popular MOS and bipolar logic families with emphasis on CMOS and TTL technologies.

II. To study the VHDL programming concepts and design of different combinational and sequential circuits using VHDL.

III. To study the design of common logic circuits, such as combinational circuits, regenerative circuits, and various types of memories.

UNIT-I	INTRODUCTION TO LOGIC FAMILIE	Classes:15

Introduction to Logic Families: Bipolar logic, Transistor logic, TTL fam

lies, CMOS logic, CMOS steadystate electrical behavior, CMOS dynamic electrical behavior, CMOS logic families.

Bipolar Logic and Interfacing: CMOS/TTL interfacing, low voltage CMOS logic and interfacing,Emitter coupled logic, Comparison of logic families, Familiarity with standard 74XX and CMOS 40XX series-ICs – Specifications.

UNIT-II	THE VHDL HARDWARE DESCRIPTION LANGUAGE	Classes:15

The VHDL Hardware Description Language: Design flow, program structure, types and constants,functions and procedures, libraries and packages.

The VHDL Design Elements: Structural design elements, data flow design elements, behavioraldesign elements, time dimension and simulation synthesis.

UNIT-III	COMBINATIONAL LOGIC DESIGN	Classes:15

Combinational Logic Design: Decoders, encoders, three state devices, multiplexers anddemultiplexers, Code Converters, EX-OR gates and parity circuits, comparators, adders & subtractors, ALUs, Combinational multipliers. VHDL modes for the above ICs.

Design Examples (Using VHDL): Design examples (using VHDL) - Barrel shifter, comparators, floating-point encoder, dual parity encoder.

UNIT-IV	SEQUENTIAL LOGIC DESIGN	Classes:15

Sequential Logic Design: Latches and flip-flops, PLDs, counters, shift register, and their VHDL models,synchronous design methodology, impediments to synchronous design.

Memories: ROMs: Internal structure, 2D-decoding commercial types, timing and applications.

Static RAM: Internal structure, SRAM timing, standard SRAMS, synchronous SRAMS.

Dynamic RAM: Internal structure, timing, synchronous DRAMs. Familiarity with Component DataSheets – Cypress CY6116, CY7C1006, Specifications.

Text Books

1. John F.Wakerly, Digital Design Principles & Practices, PHI/ Pearson Education Asia, 3rd Ed., 2005.
2. J. Bhasker, A VHDL Primer, Pearson Education/ PHI, 3rd Edition.

Reference Books

1. Charles H. Roth Jr, Digital System Design Using VHDL, PWS Publications, 2nd edition, 2008.
2. Stephen Borwn and Zvonko Vramesic, Fundamentals of Digital Logic with VHDL Design, McGraw Hill, 2nd Edition, 2005.

Web References

1. https://en.wikipedia.org/wiki/Integrated_circuit_design
2. http://web.eecs.umich.edu/~valeria/research/thesis/thesis2.pdf

E-Text Books

1. https://dvikan.no/ntnu-studentserver/kompendier/digital-systems-design.pdf
2. https://bookboon.com/en/digital-systems-design-ebook

Outcomes

1. explain electrical behavior of CMOS both in static and dynamic conditions
2. Describe the diode/transistor-transistor logic and Emitter coupled logic
3. Examine Integrated circuits for all digital operational designs like adder, subtractor, multipliers, multiplexers,registers, counters, flip flops, encoders, decoders and memory elements like RAM and ROM.
4. Design and to develop the internal circuits for different digital operations and simulate them using hardware languages using integrated circuits.
5. Understand the concepts of SSI Latches and Flip-Flops and Design of Counters using Digital ICs
6. Construct of sequential logic integrated circuits using VHDL.

LINEAR CONTROL SYSTEMS

B.Tech 5th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1503	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. In this course it is aimed to introduce to the students the principles and applications of control systems in everyday life.

II. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

UNIT-I INTRODUCTION Classes:15

Introduction: Open Loop and closed loop control systems and their differences- Examples of controlsystems- Classification of control systems- Types of feedback- Feed-Back and its Effects. Transfer Function- Impulse Response and transfer function of linear systems-Block diagram algebra –Signal flow graph - Reduction using Mason's gain formula.

Mathematical Modeling of Physical Systems: Transfer function of electrical systems-Mechanicalsystems-Electromechanical systems- Impulse Response and transfer functions - Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver.

UNIT-II TIME RESPONSE ANALYSIS Classes:15

Time Response Analysis: Standard test signals - Time response of first order systems – CharacteristicEquation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional, integral, derivative Controls.

Stability Analysis in S-Domain: The concept of stability – Routh's stability criterion – qualitativestability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT-III	FREQUENCY RESPONSE ANALYSI	Classes:15

Frequency Response Analysis: Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

Stability Analysis in Frequency Domain: Polar Plots-Nyquist Plots-Stability Analysis.

UNIT-IV	DESIGN OF COMPENSATORS	Classes:15

Design of Compensators: Compensation techniques – Lag- Lead, Lead-Lag Controllers design infrequency Domain.

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model,derivation of state models from block diagrams, Solving the Time invariant state Equations- State Transition Matrix and its Properties.

Text Books

1. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John Wiley and son's.
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 5th edition, 2007.

Reference Books

1. Control Systems –by A. Anand Kumar. PHI, 2007.
2. Automatic Control Systems –by S.N. Verma & B.S. Manke. Khanna PUBLISHERS

Web References

1. https://nptel.ac.in/courses/108104008/33
2. https://en.wikipedia.org/wiki/Control_system

E-Text Books

1. https://bookboon.com/en/electrical-electronic-engineering-ebooks
2. https://easyengineering.net/control-systems-engineering-by-nagoor-kani

Outcomes

1. Demonstrate an understanding of the fundamentals of (feedback) control systems reports.
2. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
3. Determine the (absolute) stability of a closed-loop control system
4. Determine the time and frequency-domain responses of first and second-order systems to step and sinusoidal (and to some extent, ramp) inputs.
5. Apply root-locus technique to analyze and design control
6. Express and solve system equations in state-variable form (state variable models).

ANALOG COMMUNICATIONS

B.Tech 5th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1504	Core	3	-	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. The course presents the various types of Analog Modulation schemes for transmission of Analog Information

II. Understand basic concepts of designing components like Modulators and demodulators used in design of Analog communication systems.

III. The student will understand the design of Transmitter and Receiver sections in Communication system and effect of Noise in Receivers.

UNIT-I	INTRODUCTION -COMMUNICATION SYSTEMS & LINEAR CONTINUOUS WAVE (CW) MODULATION	Classes:15

Introduction- Communication Systems & Linear Continuous Wave (Cw) Modulation

Communication Process, Elements of communication Systems - information, Messages and Signals, Communication channel, Modulation , Modulation Methods, Modulation Benefits and Applications Fundamental Limitations of communication Systems.

Double Side Band Amplitude Modulation: AM Signals and Spectra, DSB Signals and Spectra, ToneModulation, Modulators and Transmitters – Product Modulators, Square Law Modulators, Balanced Modulators and Switching Modulators. Suppressed Side Band (SSB) Amplitude Modulation - Single Side Band Signals and Spectra, Single Side Band Generation, Vestigial Side Band Signals and Spectra, Frequency Conversion and Demodulation –Frequency Conversion, Synchronous Detection, Envelope Detection, And Illustrative Problems

UNIT-II	ANGLE CONTINUOUS WAVE (CW) MODULATION: PHASE AND FREQUENCY MODULATION	Classes:15

Angle Continuous Wave (CW) Modulation: Phase and Frequency Modulation – PM and FM Signals,Narrow Band PM and FM, Tone Modulation, Multi Tone and Periodic Modulation, Transmission Bandwidth and Distortion – Transmission Estimates, Linear Distortion, Non-Linear Distortion and Limiters. Generation and Detection of PM and FM – Direct FM and VCOs, Phase Modulators and Indirect FM, Frequency Detection, Interference – Interfering Sinusoids, Pre-Emphasis and De-Emphasis Filtering, FM Capture Effect, Illustrative Problems.

UNIT-III	ANALOG COMMUNICATION SYSTEMS AND PULSE MODULATION TECHNIQUES	Classes:15

Analog Communication Systems and Pulse Modulation Techniques: Receivers for CW Modulation –Super Heterodyne receivers, direct conversion receiver, special purpose receivers, Receiver Specifications, Receiver Measurements, Multiplexing Systems, synchronous detection and frequency synthesizers using Phase Locked Loop (PLL), Linearized PLL FM detection, Illustrative Problems. Pulse amplitude modulation – Flat top sampling and Pulse amplitude modulation (PAM), Pulse-Time Modulation – Pulse Duration and Pulse Position modulations, PPM spectral analysis, Illustrative Problems.

UNIT-IV	NOISE	Classes:15

Noise: Thermal Noise & Available Power, White noise and filtered noise, Noise equivalentbandwidth, base band signal Transmission with noise- Additive Noise & S/N, Analog Signal Transmission, Noise in Analog Modulation Systems- Band Pass Noise System Models, Quadrature Components, envelope phase, Correlation Functions, Linear CW Modulation with Noise – Synchronous Detection, Envelope Detection, and Threshold Effect, Angle CW with Noise, Post detection Noise, Destination S/N, FM Threshold Effect, Analog Pulse modulation with Noise, Illustrative Problems.

Text Books

1. Simon Haykin, "Communication Systems", Wiley-India Edition, 3rd Edition, 2010.

2. A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in

Reference Books

1. B.P. Lathi, & Zhi Ding, "Modern Digital & Analog Communication Systems", Oxford University Press International, 4th edition, 2010.

2. Herbert Taub & Donald L Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd Edition, 2009.

Web References

1. http://web.eecs.utk.edu/~roberts/ECE342/Analog Communication Systems.pdf

2. https://nptel.ac.in/noc/individual_course.php?id=noc17-ec11

E-Text Books

1. https://www.pdfdrive.com/analog-and-digital-communication-books.html

2. https://www.kopykitab.com/Analog-Communication-eBook-By-P-Chakrabarti-isbn-9788176000344

Outcomes

1. Categorize different amplitude modulation techniques.
2. Categorize angle modulation techniques.
3. Categorize pulse amplitude modulation techniques.
4. Analyze receivers for continuous wave modulation.
5. Explain noise characteristics in analog communication.
6. Solve the parameters required for modulation and receivers.

ANTENNAS AND WAVE PROPAGATION

B.Tech 5th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1505	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil			Total Classes:60			

OBJECTIVES

The course should enable the students to

I. To expose the students to the basics of antennas and various types of antenna arrays and their radiation patterns.

II. To analyze the concepts of antenna radiation and fundamental pa rameters.

III. To understand the application of different antenna types and their characteristics.

UNIT-I	ANTENNA BASICS	Classes:15

Antenna Basics: Introduction, Basic antenna parameters- patterns, Beam Area, Radiation Intensity,Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective height, Illustrative problems. Fields from oscillating dipole, Field Zones, Shape-Impedance considerations, Antenna temperature, front–to-back ratio, antenna theorems, radiation- basic Maxwell's equations, retarded potential-Helmholtz Theorem.

Thin Linear Wire Antennas: Radiation from Small Electric Dipole, Quarter wave Monopole and Halfwave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Beam width, Directivity, Effective Area and Effective Height. Natural current distributions, far fields and patterns of Thin Linear Center-fed Antennas of different lengths, Illustrative problems. Loop Antennas: Introduction, Small Loop, Comparison of far fields of small loop and short dipole, Radiation Resistances and Directives of small and large loops (Qualitative Treatment).

UNIT-II	ANTENNA ARRAYS	Classes:15

Antenna Arrays: Point sources- Definition, Patterns, arrays of 2 Isotropic sources- Different cases.Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, BSAa with Non-uniform Amplitude Distributions- General considerations and Bionomial Arrays, Illustrative problems.

VHF, UHF and Microwave Antennas - I: Arrays with Parasitic Elements, Yagi - Uda Arrays, FoldedDipoles & their characteristics. Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

UNIT-III	MICRO STRIP ANTENNAS	Classes:15

Micro Strip Antennas: Introduction, features, advantages and limitations, Rectangular patchantennas- Geometry and parameters, characteristics of Micro strip antennas, Impact of different parameters on characteristics, reflector antennas- Introduction, Flar sheet and corner reflectors, paraboloidal reflectors- geometry, pattern characteristics, Feed Methods, Reflector Types- Related Features, Illustrative Problems.

Lens Antennas: Introduction, Geometry of Non-metallic Dielectric Lenses, Zoning , Tolerances,Applications.Antenna Measurements: Introduction, Concepts- Reciprocity, Near and Far Fields, Coordination system, sources of errors, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement , Gain Measurements (by comparison, Absolute and 3-Antenna Methods).

UNIT-IV	Wave Propagation	Classes:15

Wave Propagation: Introduction, Definitions, Characterizations and general classifications, differentmodes of wave propagation, Ray/ Mode concepts. Ground wave propagation (Qualitative treatment)- Introduction, Plane earth reflections, Space and surface waves, wave tilt, curved earth reflections. Space wave propagation- Introduction, field strength variation with distance and height, effect of earth's curvature, absorption. Super refraction, M-curves and duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations.

Sky Wave Propagation: Introduction, structure of Ionosphere, refraction and reflection of sky wavesby Ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-HOP propagation, Energy loss in Ionosphere, Summary of Wave Characteristics in different frequency ranges.

Text Books

1. Antennas and wave propagation – John D. Kraus, Ronald J. Marhefka and Ahmad S.Khan, TMH, New Delhi, 4th Ed., (special Indian Edition), 2010
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.

Reference Books

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 2nd ed., 2001.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.

Web References

1. http:// web.stanford.edu/class
2. http://www.electronicagroup.com
3. https://nptel.ac.in/courses/antennas

E-Text Books

1. 1.https://katie.runtnc.net/tr?id=010caa7329afcf3bebcf28f5ea6f0fa6e5519a643c. r&tk = eyJhbGciOiJIUzI1 NiIsInR5c CI6Ikp XVCJ9.ey Jwd WIiOiI1MDVjNmI4MTcxMzIwNDAyNTc1YjFkNm UiLCJ0cyI6IjA1MjEwNDE1IiwiZ CI6ImVib 29rZ2FsYXh5 LmluIn0. vf5dVhG4uCeURJzn5rn YN2Su9q0iUayl DZN2QfK UPgU
2. https://www.jntubook.com/antennas-wave-propagation-textbook

Outcomes

1. Understand the basics of antennas and various types of antenna arrays and their radiation patterns
2. Analyze the concepts of antenna radiation and fundamental parameters
3. Understand the application of different antenna types and their characteristics.
4. Learn antenna array and Array factor.
5. Differentiate various modes of Helical and Horn antennas
6. Illustrate the mechanism of the atmospheric effects on radio wave propagation

OOPS THROUGH JAVA LAB

B.Tech 5th Semester – Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16CS2409	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36			Total Classes: 36			

OBJECTIVES

The course should enable the students to

I. Emphasize this lab on intensive study of object oriented programming using JAVA

II. Concepts like inheritance,Object instantiation, number acces control will be known.

III. Concepts like constructors, string handling, events will be known.

LIST OF EXPERIMENTS

Expt. 1

a. Write a program in Java to implement the formula Area = Height * Width

b. Write a java program to find simple Interest.

c. Write a program in Java to find the average of marks obtained by a studyin five papers.

paper 1	paper 2	paper 3	paper 4	paper5	
Marks	50	60	40	29	2	48

d. Write a java program to find the sum of n num bers by reading nth value from keyboard.

To demonstrate simple statements in JAVA

Expt. 2

a. To prints all real solutions to the quadratic equation $ax^2 + bx + c = 0$. Read in a, b, c and use the quadratic for mula. If the discriminant b2 -4ac is negative, display a message stating that there are no real solu tions.

	b. Write a program in Java to explain the use of break and continue statements. c. Write a program in Java to find the result of following expression (Assume a = 10, b = 5) i) (a << 2) + (b >> 2) ii) (a) | | (b > 0) iii) (a + b *100) / 10 iv) a & b d. Write a java program to sort a given list of names in ascending order. e. Write a java program to make frequency count of words in a given text.
To demonstrate control statement in JAVA	
Expt. 3	a. Write a java program that prompts the user for an inte ger and then prints out all prime numbers up to that integer. b. Write a java program to Sort a given list of names in ascending order. c. Write a program in Java for find A*B where A is a matrix of 3*3 and B is a matrix of 3*4.
Find solutions for complex problems using JAVA programs	
Expt. 4	a. Write a program in Java with class Rectangle with the data fields width, length, area and color .The length, width and area are of double type and color is of string type .The methods are set_ length () , set_width (), set_ color(), and find_ area (). Create two object of Rectangle and compare their area and color. If area and color both are same for the objects then display "Matching Rectangles" otherwise display "Non matching Rectangle". b. Create a class Account with two overloaded construc tors. First

	constructor is used for initializing, name of account holder, account number and initial amount in account. Second constructor is used for initializing name of account holder, account number, addresses, type of account and current balance. Account class is having methods Deposit (), Withdraw (), and Get_Balance().Make necessary as sumption for data members and return types of the meth ods. Create objects of Account class and use them.
Demonstrate the concepts of Inheritance and constructors	
Expt. 5	a. Write Java program to show that private member of a super class cannot be accessed from derived classes. b. Write a program in Java to create a Player class. Inherit classes Cricket_Player, Football _Player and Hockey_ Player from Player class. c. Write a class Worker and derive classes daily worker and Salaried Worker from it. Every worker is has a name and a salary rate. Write method ComPay(in hours) to compute the week pay of every worker. A Daily Worker is paid on the basis of number of days s/he work. The Salaried Worker gets paid the wage for 40 hours a week no matter what actual hours is. Test this program to calcu late the pay of workers. You are expected to use concept of polymorphism to write this pro-gram. Consider trunk calls of a telephone exchange. A trunk call can be ordinary, urgent or lightning call. The charges depend on the duration and the type of the call. Writ a program-using concept of poly morphism in Java to calculate the chases.
To Demonstrate access specifiers inheritance and polymorphism	

Expt. 6	a.	Write a program to make a package Balance in which has Account class with Display_Balance method in it. Import Balance package in another program to access Display_Balance method of Account class.
	b.	Write a program in Java to show the usefulness of Interfaces as a place to keep constants of the program.
	c.	Write a program in java which implement inter face Student which has twomethods Display_ Grade and Atrendance for PG_Students and UG_Students(PG_Students and UG_Students are two different classes for Post Graduate and Un der Graduate students respectively). Dem onstrate the concepts like packages and interfaces in JAVA
Expt.7	a.	Write a program in Java to display name and roll number of students. Initialize respective array vari ables for 10 students. Handle ArrayIndex out of Bounds Exeption, so that any such problem doesn't cause illegal termination of program.
	b.	Write a java program to facilitate user to handle any chance of divide by zero exception.
	c.	On singles track two vehicles are running for as vehicles are going in same direction there is no problem. If the vehicles are running in same di rection there is a chance of collision. To avoid col lisions write a java program using exception han dling. You are free to make necessary assumptions.
	d.	Write program in Java for String handling which perform followings
	i)	Checks the capacity of StringBuffer objects
	ii)	Reverse the contents of a string given on console and con vert the resultant string in upper case.
	iii)	Read a string from console and append it to the resultant string of ii.

Demonstrate the concepts of exception handling and string manipulation	
Expt. 8	a. Write a program in java to read a statement from console, convert it in to uppercase and again print on console. b. Write a Java Applet program which read your name and address in different text fields and when a button named find is pressed the sum of the length of characters in name and address is displayed in another text field. Use appropriate colors, layout to make good look of your applet. c. Write a Java Applet program, which provide a text area with horizontal and vertical scrollbars. Type some lines of text in text area and use scrollbars for movements in text area. Read a word in a text field and find whether the word is in the content of text area or not.
Demonstrate the Applet concept	
Expt. 9	a. To develop an applet that displays a simple mes sage. b. To develop an applet that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named “Compute” is clicked.
Demonstrate the Applet concept	
Expt. 10	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result.
Demonstrate programming on calculator	
Expt. 11	Write a Java program for handling mouse events.
Demonstrate programming on event handling	

Expt. 12	Write a java program: a. That simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts. b. That allows the user to draw lines, rectangles and ovals.

Demonstrate programming on event handling

Reference Books

1. Cay.S.Horstmann and Gary Cornell, Core Java 2, Vol 1, Fundamentals, Seventh Edition, Pearson Education.
2. R. Nageswara Rao, Core Java, An Integrated Approach, First Edition, DreamTech press

Web References

1. https://www.ntu.edu.sg/home/ehchua/programming/java/J3f_OOPExercises.html

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS

SOFTWARE: Net beans,eclipse

HARDWARE: PC

Course Outcome

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

1. Implement Object Oriented programming concept using basic syntaxes of control Structures, strings and function for developing skills of logic building activity.
2. Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem
3. Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved.
4. Demonstrate understanding and use of different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.
5. Identify, Design & develop complex Graphical user interfaces using principal Java Swing classes based on MVC architecture

LINEAR IC APPLICATIONS LAB

B.Tech 5th Semester – Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16EC2506	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36			Total Classes: 36			

OBJECTIVES

The course should enable the students to

I. To understand the linear and non-linear applications of operational amplifiers(741)

II. To familiarize with theory and applications of 555 timers.

III. To design and construct waveform generation circuits using Op-Amp

LIST OF EXPERIMENTS

Expt. 1 **Inverting, Non – inverting and Differential amplifiers.**

To find the gain of Inverting, Non – inverting and Differential amplifiers using IC741.

Expt. 2 **IC 741 op amp applications-Adder, Substractor & differentiator circuits.**

To study the IC 741 op amp applications

Expt. 3 **Active filters-LPF, HPF.**

To Design and to find frequency response of LPF and HPF using IC741

Expt. 4 **Function generator using 741 Op-amp.**

To find the frequency of squarewave and triangular wave using IC741

Expt. 5 **IC 555 timer-Monostable operation circuits.**

To observe the waveforms of Monostable multivibrator using IC555

Expt. 6 **IC 555 timer Astable operation circuits.**

To observe the waveforms of Astable multivibrator using IC555

Expt.7 **Schmitt Trigger circuits-using IC 555.**

Design and to analyze waveform using IC 555 timer.

Expt. 8	**Voltage regulator using IC723/78XX.**
To study about voltage regulator.	
Expt. 9	**4-Bit DAC using 741 Op-amp**
To convert Analog signal to digital signal using IC741.	
Expt. 10	**IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators**
To measure the frequency of oscillator	
Expt. 11	**Design of Voltage Controlled Oscillator (VCO)- IC 566**
Design and waveform analyzation of Voltage Controlled Oscillator using IC 566.	
Expt. 12	**Design of Phase Locked Loops (PLL)- IC 565**
To study about phase locked loop	
Expt. 13	**Variable Power Supply Using LM317**
To Construct Variable Power Supply Using LM317	
Expt. 14	**Dual Power Supply Using LM 320 & LM340**
To study AboutDual Power Supply Using LM 320 & LM340	

Reference Books

1. Operational Amplifiers & Linear ICs by David A. Bell, 2nd edition, Oxford University Press, 2010.
2. Linear Integrated Circuits – D. Roy Chowdhary, New Age International (p) Ltd, 2nd Edition, 2003.

Web References

1. https://books.google.co.in/books/about Linear_ Integrated _Circuits.html?id=aByz—9D63wC
2. https://www.oreilly.com/library/view/linear-integrated-circuits/9789332558250/

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE:NIL

HARDWARE: Electronic Components, IC741, IC555,CRO, Function Generator.

Course Outcome

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

1. Design inverting and non-inverting amplifiers.
2. Designand analyze application related to IC723 and IC741 Op-Amp.
3. Design and analyze application related to IC555 Timer.
4. Design and analyze application related to IC565 & IC566.
5. Design and analyze active filters.
6. Identify, Design & develop complex Graphical user interfaces using principal Java Swing

DIGITAL IC SYSTEM DESIGN LAB

B.Tech 5th Semester – Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16EC2507	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES

The course should enable the students to

I. To understand the fundamentals of digital logic and design various combinational and sequential circuits.

II. To understand formal procedure for the analysis and design of syn chronous and asynchronous sequential logic

LIST OF EXPERIMENTS

Part –I **Minimum 6 experiments from each part to be con ducted**

Expt. 1 **Hardware laboratory using digital IC's**

1. Logic Gates- 74XX (NAND/NOR/EXOR/EXNOR).

To verify the truth table of Logic gates using IC's

Expt. 2 **Half Adder, Half Subtractor, Full Adder, Full Subtractor & Ripple Carry Adder.**

To verify the truth table of Half Adder, Half Subtractor, Full Adder, Full Subtractor & Ripple Carry Adder using Logic gates

Expt. 3 **3-8 Decoder -74X138 & 8-3 Encoder- 74X148.**

To verify the truth table of 3-8 Decoder -74X138 & 8-3 Encoder- 74X148.

Expt. 4 **8 X 1 Multiplexer -74X151 and 2x4 Demultiplexer-74X155.**

To verify the truth table of 8 X 1 Multiplexer -74X151 and 2x4 Demultiplexer-74X155.

Expt. 5	**4 bit Comparator-74X85.**
To verify the truth table of 4 bit Comparator-74X85.	
Expt. 6	**D Flip-Flop 74X74.**
To verify the truth table of D Flip-Flop 74X74.	
Expt. 7	**JK Flip-Flop 74X109.**
To verify the truth table of JK Flip-Flop 74X109.	
Expt. 8	**Decade counter-74X90.**
To verify the truth table of Decade counter-74X90.	
Expt. 9	**Universal shift register -74X194.**
To verify the truth table of Universal shift register -74X194.	
Part-II: Software Simulation using VHDL/Verilog	
Expt. 1	**Logic Gates- 74XX.**
To simulate and verify Logic Gates using VHDL	
Expt. 2	**Half Adder, Half Subtractor, Full Adder, Full Subtractor & Ripple Carry Adder.**
To simulate and verify Half Subtractor, Full Adder, Full Subtractor & Ripple Carry Adder using VHDL	
Expt. 3	**3-8 Decoder -74X138 & 8-3 Encoder- 74X148.**
To simulate and verify operation of 3:8 decoder and encoder using VHDL	
Expt. 4	**8 X 1 Multiplexer -74X151 and 2x4 Demultiplexer-74X155.**
To simulate and verify operation of Multiplexer and demultiplexer using VHDL	
Expt. 5	**4 bit Comparator-74X85.**
To simulate and verify operation of 4 bit Comparator using VHDL	
Expt. 6	**D Flip-Flop 74X74.**
To simulate and verify operation of D Flip-Flop using VHDL	
Expt. 7	**JK Flip-Flop 74X109.**
To simulate and verify operation of JK Flip-Flop using VHDL	
Expt. 8	**Decade counter-74X90.**
To simulate and verify operation of Decade counter using VHDL	

Expt. 9	Universal shift register -74X194.

To simulate and verify operation of Universal shift register using VHDL

Expt. 10	Barrel Shifter / ALU/Carry Look Ahead adder

To simulate and verify operation of Barrel Shifter / ALU/Carry Look Ahead adder using VHDL

Reference Books

1. Charles H. Roth Jr, Digital System Design Using VHDL, PWS Pub lications, 2nd edition, 2008.
2. Stephen Borwn and Zvonko Vramesic, Fundamentals of Digital Logic with VHDL Design, McGraw Hill, 2nd Edition, 2005.

Web References

1. https://en.wikipedia.org/wiki/Integrated_circuit_design
2. http://www.vlab.co.in/broad-area-electronics-and-communications

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS

SOFTWARE: XILINX ISE

HARDWARE: PC, Electronic Components, Different IC's,CRO,Function Generator.

Course Outcome

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

1. explain electrical behavior of CMOS both in static and dynamic con ditions
2. Describe the diode/transistor-transistor logic and Emitter coupled logic
3. Examine Integrated circuits for all digital operational designs like adder, subtractor, multipliers, multiplexers, registers, counters, flip flops, en coders, decoders and memory elements like RAM and ROM.
4. Design and to develop the internal circuits for different digital opera tions and simulate them using hardware languages using integrated circuits.
5. Understand the concepts of SSI Latches and Flip-Flops and Design of Counters using Digital ICs
6. Construct of sequential logic integrated circuits using VHDL.

TERM PAPER

B.Tech 5th Semester –Electronics & Communication Engineering								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
16AS3501	-	-	-	-	2	0	50	50
Contact Classes: 24	**Tutorial Classes: Nil**		**Practical Classes: Nil**			**Total Classes: 24**		

OBJECTIVES

The course should enable the students to

I. Guide students through the process of planning and executing a substantial project.

II. Allow students the opportunity to teach themselves.

III. Improves the power of designing, organizing, communication, coordination and judgment.

The Term Paper is a self study report and shall be carried out either during 5th Semester along with other lab courses. Every student will take up this term paper individually and submit a report. The scope of the term paper could be an exhaustive literature review choosing any engineering concept with reference to standard research papers or an extension of the concept of earlier course work in consultation with the term paper supervisor. The term paper reports submitted by the individual students during the 5th Semester shall be evaluated for a total of 50 marks for external evaluation, it shall be conducted by two Examiners, one of them being term paper supervisor as internal examiner and an external examiner nominated by the Principal from the panel of experts recommended by HOD.

Outcomes

1. Prepare comprehensive report based on literature survey related to considered area
2. Select the paper to be solved and analyze the extension possibilities
3. Identify the applicability of modern software tools and technology
4. Correct himself to improve write-up skills
5. Exhibit the professional behavior

QUANTITATIVE APTITUDE

B.Tech 5th Semester: Electronics & Communication Engineering								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
16AS3502	-	-	-	-	1	0	50	50
Contact Classes: 12	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 12**		

The external examination will be conducted for 50 Marks with 1 Credit; examination type is Multiple Choice Question (MCQ) – Offline/Online.

OBJECTIVES

The course should enable the students to

1. Formulate the problem quantitatively and use appropriate arithmeti cal methods to solve the problem.
2. Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
3. Solve campus placements aptitude papers covering Quantitative Ability
4. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

UNIT-I	**Classes:3**
Calendars, Clocks, L. C. M & H. C. F, Problems on Numbers, Averages.	
UNIT-II	**Classes:3**
Percentages, Profit, Loss & Discount, Simple Interest & Compound Interest.	
UNIT-III	**Classes:3**
Ratio & Proportion, Mixture and Alligation, Partnership, problems on ages.	
UNIT-IV	**Classes:3**
Time & Work, Pipes and Cisterns, Time & Distance, Problem on Trains, Boats and Streams, Mensuration.	

Text Books

1. Dr. R.S. Aggarwal, "Quantitative Aptitude", S.Chand Publication, New Delhi.

Reference Books

1. Quantitative Aptitude - G. L BARRONS
2. Abhijit Guha, "Quantitative Aptitude for Competitive Examinations", 4th Edition.

Web References

1. www.indiabix.com
2. https://www.campusgate.co.in
3. https://m4maths.com

PROFESSIONAL ACTIVITIES-III

B.Tech 5th Semester: Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
16AS3503	-	L	T	P	C	CIA	SEE	Total
		-	-	-	1	-	-	-
Contact Classes: 12	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 12			

OBJECTIVES

The course should enable the students to:

1. Improve communication skills
2. Develop leadership qualities

Professional Society Activities (PSA) course is aimed at enhancing the self-learning, communication, managerial skills of the students by engaging them in various Co & Extra Curricular activities during their course of study. Activities in each of the department shall be designed and conducted by the Professional Society Executive Committee whose composition is:

1. Faculty Mentors- 2 No.
2. Student Chairman: 1 No.- Final year Student
3. Student General Secretary: 1 No.- Third year Student
4. Treasurer: 1 No.- Third year Student

Student Members: 2 No's from each class

PSA related activities would be of the following nature but not limited to:

Activity#1	Just A Minute
Activity#2	Technical Quiz
Activity#3	Open House- Lab Demo
Activity#4	Technical Paper Presentation- Preliminary
Activity#5	Technical Paper Presentation- Final
Activity#6	Poster Presentation
Activity#7	Collage- A theme based event
Activity#8	Debate Competition
Activity#9	Group Discussion Competition
Activity#10	Mock Interviews
Activity#11	Model Exhibition
Activity#12	Valedictory Function

VLSI DESIGN

B.Tech 6th Semester: Electronics & Communications Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1601	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil			Total Classes:60			

OBJECTIVES

The course should enable the students to

I. Understand the Fabrications steps of MOS and BiCMOS technologies.

II. Learn the Basic NMOS, CMOS & BiCMOS circuits.

III. Understand NMOS & CMOS process technology

IV. Learn Technology Scaling and Designing of VLSI subsystems

V. Write a Program on digital system using Hardware Description Language

UNIT-I	INTRODUCTION	Classes:15

Introduction to IC technology-MOS, PMOS, NMOS, CMOS and BI-CMOS technologies-oxidation, lithiography, diffusion, Ion implantation, metallisation , Encapsulation, probe testing, Integrated Resistors And Capacitors, Current Mirror Circuits

Basic Electrical Properties: Basic electrical properties of MOS and BI-CMOS circuits: Ids-Vdsrelationships, MOS transistor threshold voltage, gm, gds, figure of merit; pass transistor, NMOS inverter, various pull-ups, CMOS inverter analysis and design, BI-CMOS inverters.

UNIT-II	VLSI CIRCUIT DESIGN PROCESSES	Classes:15

VLSI design flow, MOS layers, stick diagrams, design rules and layout,2 m CMOS design rules for wires, contacts and transistors layout diagrams for NMOS and CMOS inverters and gates, scaling of MOS circuits, limitations of scaling.

GATE Level Design: Logic gates and other complex gates, switch logic, alternate gate circuits, basiccircuit concepts, sheet resistance RS and its concept to MOS, area capacitance units, calculations-(Micro)-delays, driving large capacitive loads, wiring capacitances, fan-in and fan-out, choice of layers.

UNIT-III	SUB SYSTEM DESIGN	Classes:15

Sub system design, shifters, adders, ALUs, multipliers, parity generators,comparators, zero/one detectors, counters, high density memory elements.

Semiconductor Integrated Circuit Design: PLAs, FPGAs, CPLDs, standard cells, programmable arraylogic, design approach.

UNIT-IV	VHDL SYNTHESIS	Classes:15

VHDL synthesis, circuit design flow, circuit synthesis, simulation, layout, designcapture tools, design verification tools, test principles.

CMOS Testing: CMOS testing need for testing, test principles, design strategies for test, chip leveltest techniques, system-level test techniques, layout design for improved testability

Text Books

1. Kamran Eshraghian, Eshraghian Dougles and A.Pucknell, Essentials of VLSI circuits and systems, PHI 2005 Edition.
2. Weste and Eshraghian, Principles of CMOS VLSI design, Pearson Education, 1999.

Reference Books

1. John P.Uyemura, Introduction to VLSI circuits and systems, John Wiley, 2003
2. John M. Rabaey, Digital Integrated circuits, PHI, EEE, 1997

Web References

1. https://en.wikipedia.org/wiki/Very_Large_Scale_Integration
2. https://ieeexplore.ieee.org/document/6004383? reload=true & arnumber = 6004383

E-Text Books

1. V.S. Bagad, VLSI Design, Technical Publications, 2009.
2. Zhongfeng Wang, Intech Publishers.

Outcomes

1. Explain the operation and characteristics of MOS transistor
2. Interpret various MOS transistor fabrication techniques
3. Implement Boolean functions in CMOS technology and realize the same in layout diagrams
4. Summarize the effects of parasitics and scaling
5. Classify various programmable ASICs
6. Interpret different levels of testing of IC

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

B.Tech 5th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EE1505	Core	3	1	0	3	40	60	100
Contact Classes:55	Tutorial Classes: 10	Practical Classes: Nil				Total Classes:65		

OBJECTIVES

I. Understand then ecessity and importance of Measurement & Instrumentation.

II. To know about various kinds of measurement techniques, instruments, sensor &transducers.

UNIT-I	MEASURING INSTRUMENTS, INSTRUMENT TRANSFORMERS	Classes:15

Measuring Instruments: Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC , moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunt and series resistance - Types of P.F. Meters – 1-ph and 3-ph meters: dynamometer & moving iron type.

Instrument Transformers: Construction and principle of operation CT and PT – Ratio and phase angle errors.

UNIT-II	MEASUREMENT OF POWER / ENERGY, POTENTIOMETERS	Classes:17

Measurement of Power / Energy: Single phase dynamometer wattmeter, LPF and UPF, expression for deflecting and control torques. Single phase induction type energy meter – driving and braking torques – errors and compensations- Three phase energy meter.

Potentiometers: Principle and operation of D.C. Crompton‘s potentiometer- standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate types- standardization - applications.

UNIT-III	D.C BRIDGES & A.C BRIDGES	Classes:17

D.C Bridges: Method of measuring low, medium and high resistance – sensitivity of Whetstone's bridge – measurement of low resistance: Kelvin's double bridge - measurement of high resistance: loss of charge method

A.C Bridges: Measurement of low & high inductance - Maxwell's, Hays and Anderson's bridge - Measurement of capacitance and loss angle – Desauty, Schering and Wien's bridge.

UNIT-IV	MAGNETIC MEASUREMENTS, DIGITAL METERS, TRANSDUCERS	Classes:16

Magnetic measurements: Determination of B-H loop, method of reversals, measurement of flux.

Digital Meters: Digital Voltmeter-Successive approximation, ramp and integrating type-Digital frequency meter-Digital multimeter-Digital Tachometer:

Transducers: Definition of transducers, Classification of transducers- Principle operation of LVDT transducers- Strain gauge and its principle of operation.

Text Books

1. A.K.Sawhney "Electrical & Electronic Measurement & Instruments" Dhanpat Rai & Co. Publications. 1994
2. R.K.Rajput "Electrical & Electronic Measurement & Instrumentation", S. Chand & Co 2nd Edition. 2008

Reference Books

1. D O Doeblin "Measurements Systems, Applications and Design",Mc Graw Hill Edition.
2. Buckingham and Price "Electrical Measurements ", Prentice Hall of India.

Web References

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com
5. https://www.iare.ac.in

E-Text Books

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

Outcomes

1. Understand the various Measuring instruments used to detect various electrical quantities.
2. Gain knowledge about measuring electrical parameters using AC and DC bridges
3. Analyze the various Types of Instrument Transformers.
4. Enhance student knowledge how a Measuring instruments can be designed to reduce the errors and to increase efficiency.
5. Become familiar with Analog and Digital instruments.

DIGITAL COMMUNICATIONS

B.Tech 6th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1603	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: - 10		Practical Classes: Nil			Total Classes:60		

OBJECTIVES

The course should enable the students to

I. Understand basic components of digital communication systems.

II. Learn the basic modulation techniques used in base band and band pass data transmission

III. Learn the concept of information theory regarding digital information representation

IV. Learn basic channel coding techniques for error detection & correction process

UNIT-I	DIGITIZATION TECHNIQUES FOR ANALOG MESSAGES	Classes:15

Introduction - Importance of Digitization Techniquesfor Analog Messages, Pulse Code Modulation (PCM) - Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, PCM with Noise, Decoding Noise, Error Threshold, PCM versus Analog Modulation.Delta modulation, Adaptive Delta Modulation, Differential PCM systems (DPCM), Digital Multiplexing-Multiplexers and Hierarchies.

UNIT-II	BASE BAND DIGITAL TRANSMISSION	Classes:15

Digital Signals and Systems – Digital PAM Signals, TransmissionLimitations, Power Spectra of Digital PAM, Noise and Errors – Binary Error Probabilities, Matched Filtering, Correlation Detection.Band Limited Digital PAM Systems – Nyquist Pulse Shaping, Optimum Terminal Filters, Correlative Coding

UNIT-III	BAND PASS DIGITAL TRANSMISSION	Classes:15

Digital CW Modulation – Spectral Analysis of Digital Band PassSignals, Signal Space, Gram-Schmidt Procedure, Coherent Binary Systems – Optimum Binary Detection, Coherent ASK (OOK (on-off keying), BPSK and FSK, Timing and Synchronization, Interference, Non-Coherent Binary Systems, Non-Coherent FSK, Differentially Coherent PSK. Quadrature Carrier and M–ary Systems- Quadrature Carrier Systems, M–ary PSK Systems, M–ary QAM Systems, M–ary FSK Systems, and Comparison of Digital Modulation Systems, digital communication standards.

UNIT-IV	INFORMATION THEORY AND CODING	Classes:15

Information Measure and Encoding - Information Measure, Entropyand Information Rate, Coding for a Discrete Memory Less Channel, Information transmission on a discrete channels - mutual information, Binary Symmetric Channel, Discrete Channel Capacity, Coding for the Binary Symmetric Channels. Error Detection & Correction - Repetition & Parity Check Codes, Interleaving, Code Vectors and Hamming Distance, Forward Error Correction (FEC) Systems, Automatic Retransmission Query (ARQ) Systems, Linear Block Codes – Matrix Representation of Block Codes, Convolution Codes – Convolutional Encoding, Decoding Methods.

Text Books

1. A. Bruce Carlson, & Paul B. Crilly, “Communication Systems – An Introduction to Signals & Noise in Electrical Communication”, McGraw-Hill International Edition, 5th Edition, 2010
2. Sam Shanmugam, “Digital and Analog Communication Systems”, John Wiley, 2005

Reference Books

1. Bernard Sklar, “Digital Communications”, Prentice-Hall PTR, 2nd edition, 2001
2. Simon Haykin, “Communication Systems”, Wiley-India edition, 3rd edition, 2010

Web References

1. http://userspages.uob.edu.bh/mangoud/mohab/Courses_files/sklar.pdf
2. https://en.wikipedia.org/wiki/Data_transmission

E-Text Books

1. Upamanyu Madhow, Cambridge University Press, 2008.
2. Robert G Gallager, Principles of Communication Engineering, Cambridge University Press, 2008.

Outcomes

1. Categorize digitization techniques for analog messages.
2. Explain base band digital transmission
3. Explain band-pass data transmission
4. Explain source coding principle and methods for encoding.
5. Explain different types of error control coding methods.
6. Solve the parameters required for transmission, source coding and error control coding.

MICROPROCESSORS AND MICROCONTROLLERS

B.Tech 6th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1604	Core	3	1	0	3	40	60	100
Contact Classes:60	Tutorial Classes: 5	Practical Classes: Nil				Total Classes:65		

OBJECTIVES

I. The objective of this course is to become familiar with the architecture and the instruction set of an Intel microprocessor

II. Assembly language programming will be studied as well as the design of various types of digital and analog interfaces

III. Understand the architecture of 8085 and 8051

UNIT-I	INTRODUCTION, ASSEMBLY LANGUAGE PRO GRAMMING	Classes:16

Introduction: Introduction to 8085, Architecture of 8086 microprocessor, special functions of general purpose registers.8086 flag register and function of 8086 flags, addressing modes of 8086,instruction set of 8086.assembler directives, simple programs, procedures and macros.

Assembly Language Programming: Assembly language programs involving logical, branch and call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

UNIT-II	DETAILS OF 8086 & INTERFACING, PROGRAMMABLE INTERFACING DEVICES	Classes:18

Details of 8086 & Interfacing: Pin diagram of 8086-Minimum mode and maximum mode of operation, Timing diagram, memory interfacing to 8086(static RAM and EPROM). Need for DMA. DMA data transfer method. Interfacing with 8237/8257.

Programmable Interfacing Devices: 8255 PPI-various modes of operation and interfacing to 8086.interfacing keyboard, displays, 8279 stepper motor and actuators. D/A and A/D converter interfacing, Interrupt structure of 8086, Vector interrupt table. Interrupt service routines.

UNIT-III	SERIAL DATA TRANSFER SCHEMES, PROGRAMMABLE INTERRUPT CONTROLLERS	Classes:15

Serial Data Transfer Schemes: Asynchronous and synchronous data transfer schemes.8251 USART architecture and interfacing.TTL to RS232C and RS232C to TTL conversion. Sample program of serial data transfer. Introduction to high-speed serial communications standards, USB.

Programmable Interrupt Controllers: 8259 PIC architecture and interfacing cascading of interrupt controller and its importance, Programming with 8259, Programmable interval timer 8253, Modes of 8253, Programming examples with 8253.

UNIT-IV	8051 MICROCONTROLLER AND ITS PROGRAMMING, ADVANCED MICROCONTROLLERS	Classes:16

8051 Microcontroller and Its Programming: Architecture of micro controller-8051 Microcontroller- internal and external memories-counters and timers-synchronous serial-cum asynchronous serial communication-interrupts. Addressing modes of 8051, Instructor set of 8051, Assembly Language/C Programming examples using 8051.

Advanced Microcontrollers: ARM Microcontrollers: ARM Core Architecture, Versions of ARM, Important Features. Programming examples of ARM using IDE.

Text Books

1. Advanced microprocessor and peripherals-A.K. Ray and K.M.Bhurchandi, 2nd edition, TMH, 2000.
2. Microcontrollers-Deshmukh, Tata Mc-Graw Hill Edition, 2004.

Reference Books

1. Microprocessors Interfacing-Douglas V.Hall, 2nd edition, 2007.
2. The 8088 and 8086 Microprocessors- Walter A. Triebel, Avtar Singh, PHI, 4th Edition, 2003.

Web References

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com
5. https://www.iare.ac.in

E-Text Books

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

Outcomes

1. learn the basic microprocessor architecture and to gain knowledge on interfacing components with processors and micro controllers
2. learn the fundamentals architectures of 8255, 8259, 8086 programming in assembly language, Software Design Kit (SDK), System integration with 8086
3. learn different Communication protocols like RS232, SPI, and I2C

Digital Signal Processing

B.Tech 7th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1605	Core	3	-	-	3	40	60	100
Contact Classes:65	Tutorial Classes: -	Practical Classes: Nil				Total Classes:65		

OBJECTIVES

I. To study DFT and its computation

II. To study the design techniques for digital IIR and FIR filters

III. To study the finite word length effects in digital signal processing

UNIT-I	DIGITAL SIGNALS	Classes:18

Introduction: Introduction to digital signal processing: Discrete time signals and sequences, linear shift invariant systems, stability and causality, linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems.

Discrete Fourier Series: Properties of discrete Fourier series, DFS representation of periodic sequences, discrete Fourier transforms: properties of DFT, linear convolution of sequences using DFT, computation of DFT. Relation between Z-Transform and DFS.

UNIT-II	FAST FOURIER TRANSFORMS & DIGITAL FILTERS	Classes:17

Fast Fourier Transforms: Fast Fourier transforms (FFT)-Radix2 decimation in time and decimation in frequency FFT algorithms, inverse FFT and FFT for composite N.

Realization of Digital Filters: Review of Z-transforms, applications of Z-Transforms, solution of difference equations of digital filters, block diagram representation of linear constant-coefficient difference equations, basic structures of IIR systems, transposed forms, basic structures of FIR systems, system function

UNIT-III	IIR DIGITAL FILTERS	Classes:15

IIR Digital Filters: Analog filter approximations-Butterworth and chebyshev, design of IIR digital filters from analog filters, design examples: analog-digital transformations, Illustrative Problems.

FIR Digital Filters: Characteristics of FIR digital filters, frequency response. Design of FIR digital filters using window techniques, frequency sampling technique, comparison of IIR and FIR filters, Illustrative Problems

UNIT-IV	MULTIRATE DIGITAL SIGNAL PROCESSING	Classes:15

Multirate Digital Signal Processing Fundamentals: Basic sample rate alteration devices, Multirate Structures for sampling rate Converters, Multistage design of decimator and Interpolator, Polyphase Decomposition, Nyquist filters.

Applications of Digital Signal Processing: Spectral analysis of no stationary Signals, Musical Sound processing, signal Compression, Transmultiplexers, Discrete Multitone Transmission of digital data.

Text Books

1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris

   G.Manolakis, Pearson Education/PHI, 4th ed., 2007.

2. Digital signal processing , A computer base approach- Sanjit K Mitra, Tata McGraw Hill, 3rd

   Edition, 2009.

Reference Books

1. Digital signal processing: Andreas Antoniou, TATA McGraw Hill, 2006.
2. A Text book on Digital Signal processing – R S Kaler, M Kulkarni,, Umesh Gupta, I K

   International Publishing House Pvt. Ltd.

Web References

1. https://www.researchgate.net
2. https://www.facstaff.bucknell.edu/
3. https://www.electrical4u.com
4. https://www.audisankara.ac.in

E-Text Books

1 .https://www.jntubook.com/

2. https://www.freeengineeringbooks.com

Outcomes

1 : Classify Discrete time signals and systems

2 : Apply discrete Fourier transform on time domain signals

3 : Analyze the signals in Time and Frequency domain through its respective tools

4 : design the FIR and IIR digital filters with given specifications

5 : Examine the frequency response characteristics of FIR and IIR digital filters

6 : Know the applications of Digital signal processing

DIGITAL TELEVISION (Elective – I)

B.Tech 6th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1606	Elective	3	-	-	3	40	60	100
Contact Classes:50	Tutorial Classes: - 10		Practical Classes: Nil			Total Classes:60		

OBJECTIVES

The course should enable the students to

I. Know the evolution of television systems

II. Learn digitization principles on composite television signal

III. Classify the types of compression standards

IV. Learn the television display, storage devices

UNIT-I	INTRODUCTION	Classes:15

Raster images – Quantization – Image structure – Brightness and contrast – Raster scanning – Resolution – Introduction to luma and chroma.

Image digitization – Perception and visual acuity – Luminance and lightness – CIE system of colorimetry – Color science – Video signal processing – Gamma – Luma and color differences.

UNIT-II	DIGITAL TELEVISION	Classes:15

Digital Television types – JPEG – Video compression – MPEG2, MPEG4, H264, Motion – JPEG (M-JPEG) compression

UNIT-III	HIGH DEFINITION TV	Classes:15

HDTV evolution and role of Grand Alliance – HDTV compressed video and audio streams – Packetized transport –Transmission – HDTV receiver – HDTV standards – Metadata broadcasting.

UNIT-IV	DTV FUTURE AND ACCESSORIES	Classes:15

3D TV – Plasma, LCD, Digital Light Processing – HDMI – Digital Video Disk (DVD), Blue Ray Disk, Super hi-vision.

Text Books

1. Philip J. Cianci, "HDTV and the Transition to Digital Broadcasting: Understanding New Television Technologies", Focal Press, 2007.
2. Iain E. G. Richardson, "H.264 and MPEG-4 and Video compression video coding for Next-generation Multimedia", John Wiley & Sons Ltd., 2003.

Reference Books

1. Ibrahim.K.F, "Newnes Guide to Television and Video Technology", Newnes Publishers, 2007.
2. Charles poynton, "Digital Video and HDTV Algorithms and Interfaces", Morgan Kaufman publishers, 2007.

Web References

1. https://www.sciencedirect.com/book/9780240520810/digital-television
2. https://en.wikipedia.org/wiki/Digital_television

E-Text Books

1. W. Fischer and Horst Renouard, Digital Television: A Practical Guide for Engineers, Springer, 2013
2. Handbook on Digital Terrestrial Television Broadcasting Networks and Systems Implementation, ITU-R, 2016.

Outcomes

1. Understand the evolution of television systems
2. Illustrate the digitization principles .
3. Classify the types of compression standards.
4. Understand the basics of HIGH DEFINITION TV.
5. Understand the basics of DTV FUTURE AND ACCESSORIES .
6. Illustrate about Metadata broadcasting.

COMPUTER NETWORKS (Elective – I)

B.Tech 6th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1607	Elective	3	-	-	3	40	60	100
Contact Classes:50	Tutorial Classes: - 10		Practical Classes: Nil			Total Classes:60		

OBJECTIVES

The course should enable the students to

I. Understands fundamentals of networks and overview of data communications

II. Understand different network models: OSI, TCP/IP models

III. Understand UDP, IEEE 802 wireless standards and various network protocols.

IV. Know the basics of networks and applications of network technology.

UNIT-I	INTRODUCTION TO COMPUTER COMMUNICATION	Classes:15

Uses of Computer Networks, Network Hardware, TheOSI Reference Model, The TCP/IP Reference Model, Example Networks, Data communications fundamentals.

The Physical Layer: Guided Transmission Media, Wireless Transmission

UNIT-II	THE DATA LINK LAYER	Classes:15

Data Link Layer Design Issues, Error Detection And Correction, Elementary DataLink Protocols, Sliding Window Protocols**,** Example Data Link Protocols.

Medium Access Control Sub Layer: The Channel Allocation Problem, Multiple Access Protocols,Ethernet, Wireless LANS, Data Link Layer Switching.

UNIT-III	THE NETWORK LAYER	Classes:15

Network Layer Design Issues, Routing Algorithms, Congestion ControlAlgorithms, Internetworking, The Network Layer in the Internet.

UNIT-IV	THE TRANSPORT LAYER	Classes:15

The Transport Service, Elements of Transport Protocols, the Internet TransportProtocols; UDP, the Internet Transport Protocols; TCP.

The Application Layer: The Domain Name System, Electronic Mail, the World Wide Web.

Application Layer: Basics of Domain Name System, Basics of SNMP, Basics of Electronic Mail & TheWorld WEB, Basics of Multi Media.

Text Books

1. Computer Networks, Andrew S Tanenbaum , ,4th Edition, Pearson Education/PHI.
2. Computer Networks, Bhushan Trivedi

Reference Books

1. Data Communications and Networking, Behrouz A. Forouzan. 4th Edition, TMH.
2. An Engineering Approach to Computer Networks, S.Keshav, 2nd Edition, Pearson Education.

Web References

1. https://en.wikipedia.org/wiki/Computer_network
2. https://www.wikilectures.eu/w/Computer_Network

E-Text Books

1. Peter L Dordal, An Introduction to Computer Networks, 2019.
2. Andrew S. Tanenbaum and David J. Watherall, Prentice Hall, 2011.

Outcomes

1. Discuss the different types of communication media.
2. Explain the fundamentals of networking.
3. Compare the different types network models: TCP/IP, OSI, etc.
4. Compare the various network Protocols
5. Examine the multimedia
6. Explain the basics of networks and applications of network technologies

TELECOMMUNICATIONS SWITCHING TECHNIQUES

(Elective – I)

B.Tech 6th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1608	Elective	3	-	-	3	40	60	100
Contact Classes:50	Tutorial Classes: - 10		Practical Classes: Nil			Total Classes:60		

OBJECTIVES

The course should enable the students to

I. Understand the basic concepts related to telecommunication switching networks.

II. Know different types of networks.

III. Learn about Integrated Services Digital Network (ISDN)

IV. Learn about DSL Technology

UNIT-I	TELECOMMUNICATION SWITCHING SYSTEMS	Classes:15

Introduction, Elements of switching systems, switchingnetwork configuration, principles of cross bar switching. Electronic space division switching, Time division switching, Combination switching.

UNIT-II	TELEPHONE NETWORKS	Classes:15

Subscriber loop systems, switching hierarchy and routing, transmission plan,numbering plan, charging plans.

Signaling Techniques: In channel signaling, common channel signaling. Network traffic load andparameters, grade of service and blocking probability.

UNIT-III	DATA COMMUNICATION NETWORKS	Classes:15

Introduction, network architecture, layered network architecture,protocols, data communications hardware, data communication circuits. Public switched data networks, connection oriented & connection less service, Circuit Switching, packet switching and virtual circuit switching concepts, OSI reference model, LAN, WAN, MAN & Internet. Repeaters, Bridges, Routers and gate ways.

UNIT-IV	INTEGRATED SERVICES DIGITAL NETWORK (ISDN)	Classes:15

Introduction, motivation, ISDN architecture, ISDNinterfaces, functional grouping, reference points, protocol architecture, signaling, numbering, addressing, BISDN.

DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM &CMTS and DOCSIS. SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS I, Virtual Tributaries and Higher rate of service.

Text Books

1. Tele communication switching system and networks - Thyagarajan Viswanath, PHI, 2000
2. Advanced electronic communications systems - Wayne Tomasi, PHI, 2004

Reference Books

1. Digital telephony - J. Bellamy, John Wiley, 2nd edition, 2001
2. Data Communications & Networks - Achyut. S.Godbole, TMH, 2004

Web References

1. https://en.wikipedia.org/wiki/Packet_switching
2. https://www.rand.org/pubs/research_memoranda/RM3420.html

E-Text Books

1. Kirstein, Peter, Early Experiences with the ARPANET and INTERNET in the UK. University College London, 2017.
2. Vinton G. Cerf; Robert E. Kay. A Protocol for Packet Network Intercommunication. IEEE Transactions on Communications. 22 (5): 637–648.

Outcomes

1. Discuss about the basics of telecommunication switching systems.
2. Classify & Compare different types of telecommunication Switching Methods.
3. Categorize different Telephone Networks & Signaling Techniques.
4. Explain about different Data Communication Hardware.
5. Investigate different types of Data communication Networks.
6. Explain about ISDN& DSL Technologies.

AVAILABLE SELECTED MOOCs (ELECTIVE-I)

B.Tech 6th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
16EC1609	Elective	L	T	P	C	CIA	SEE	TOTAL
		3	-	-	3	40	60	100
Contact Classes: -	Tutorial Classes: -	Practical Classes: Nil				Total Classes: -		

Meeting with the global requirements, to inculcate the habit of self learning and incompliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion for the course from the MOOCs providers

Regulations for MOOCs

- The respective departments shall give a list from NPTEL or any other standard providers, whose credentials are endorsed by the HOD.
- Each department shall appoint Coordinators/Mentors and allot the students to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same.
- A student shall choose an online course (relevant to his/her programme of study) from the given list of MOOCs providers, as endorsed by the teacher concerned, with the approval of the HOD.
- The details of MOOC(s) shall be displayed in Grade card of a student, provided he/she submits the proof of completion of it to the department concerned through the Coordinator/Mentor.
- Student can get certificate from SWAYAM/NPTEL or any other standard providers, whose credentials are endorsed by the HOD. The course work should not be less than 12 weeks or student may appear for end examination conducted by the Institute.
- There shall be one Mid Continuous Internal Examination (Quiz exam for 40 marks) after 9 weeks of the commencement of the course and semester end examination (Descriptive exam for 60 marks) shall be done along with the other regular courses.
- Three credits will be awarded upon successful completion of each MOOC courses having minimum of 8 weeks duration.

VLSI DESIGN LABORATORY

B.Tech 6th Semester – Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16EC2611	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES

The course should enable the students to

I. Understand the Fabrications steps of MOS and BiCMOS technologies.

II. Learn the Basic NMOS, CMOS & BiCMOS circuits.

III. Understand NMOS & CMOS process technology

IV. Learn Technology Scaling and Designing of VLSI subsystems

V. Write a Program on digital system using Hardware Description Language

LIST OF EXPERIMENTS

Expt. 1 **Part I: Designing and analysis (DC, AC, Transient) of Circuit models through CADENCE or MICROWIND**

Modeling and analysis of PMOS & NMOS transistor

To Design PMOS and NMOS Transistor and Schematic Capture of Transistor by Performing Layout Extraction

Expt. 2 **Designing and Extracting, the layout of CMOS inverter.**

To Design an Inverter and Schematic Capture of Inverter by Performing Layout Extraction

Expt. 3 **Designing and Extracting the layout of logic gates.**

To Design and Implement Logic Gates by using FPGA or CPLD Device

Expt. 4	**Designing and Extracting layout of Common source amplifier**
To Develop, Implement and Schematic Capture of Common Source Amplifier by Performing Layout Extraction	
Expt. 5	**Designing and Extracting layout of Single stage dif ferential amplifier**
To Develop, Implement and Schematic Capture of Single Stage Differential Amplifier by Performing Layout Extraction	
Expt. 6	**Part II: Design and Implementation using Verilog program and FPGA** **Implementations of given Boolean function through HDL language, and verifying the functionality with FPGA** **Design a decimal up/down counters that counts up from 00 to 99 and vice versa**
To Design and Implement Decimal Up/ Down Counter by using FPGA Device	
Expt. 7	**Design an 8 Bit parity generator (with for loop and Generic statements)**
To Design and Implement 8 Bit Parity Generator by using FPGA Device	
Expt. 8	**Ripple Carry Adder**
To Design and Implement Ripple Carry Adder by using FPGA Device	
Expt. 9	**Carry look ahead**
To Design and Implement Carry Look Ahead Adder by using FPGA Device	
Expt. 10	**8- bit comparator**
To Design and Implement 8-Bit Comparator by using FPGA Device	
Expt. 11	**Flip-Flops**
To Develop and Implement SR Flip Flop, JK Flip Flop, D Flip Flop, T Flip Flop by using FPGA Device	

Expt. 12	Shift Register

To Develop and Implement Serial in Parallel Out Register, Parallel in Serial out by using FPGA and CPLD Device

Expt. 13	Barrel shift register

To Develop and Implement Barrel Shifter by using FPGA Device

Expt. 14	ALU

To Develop and Implement Arithmetic Logic Unit by using FPGA Device

Reference Books

1. John P.Uyemura, Introduction to VLSI circuits and systems, John Wiley, 2003
2. John M. Rabaey, Digital Integrated circuits, PHI, EEE, 1997

Web References

1. https://en.wikipedia.org/wiki/Very_Large_Scale_Integration
2. https://ieeexplore.ieee.org/document/6004383?reload = true&arnumber = 6004383

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: Microwind 2.1v, 45nm Technology

HARDWARE: Desktop Computers (04 no's)

Course Outcome

1. Understand the Verilog hardware description language
2. Model a Combinational circuits using hardware description language Verilog HDL and validate its functionality
3. Design and implement a subsystem on a FPGA board
4. Model a Sequential circuits using hardware description language Verilog HDL and validate its functionality
5. Design and Model different MOS circuits

ANALOG AND DIGITAL COMMUNICATION LABORATORY

B.Tech 6th Semester – Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16EC2612	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES

The course should enable the students to

I. Understand basic components of digital communication systems.

II. Learn the basic modulation techniques used in base band and band pass data transmission

III. The course presents the various types of Analog Modulation schemes for transmission of Analog Information

IV. Understand basic concepts of designing components like Modulators and demodulators used in design of Analog communication systems.

LIST OF EXPERIMENTS

Expt. 1 **ANALOG COMMUNICATION**

Amplitude Modulation and Demodulation

To Study Amplitude Modulation and Demodulation using AM Demonstrator

Expt. 2 **Frequency Modulation and Demodulation**

To Study the Frequency Modulation and Demodulation and also to Study the Effect of Variation of Modulation Index on Modulated Signal

Expt. 3 **Characteristics of Mixer**

To Construct and Study the Characteristics of Mixer

Expt. 4 **Pre-Emphasis and De-Emphasis**

To Study the Characteristics of Pre- Emphasis and De- Emphasis Networks

Expt. 5 **Pulse Amplitude Modulation and Demodulation**

To Study the Process of Pulse Amplitude Modulation and Demodulation

Expt. 6	**Pulse Width Modulation and Demodulation**
To Study the Process of Pulse Width Modulation and Demodulation, To Study the Effect of Sampling Frequency	
Expt. 7	**Pulse Position Modulation and Demodulation**
To Study the Process of Pulse Position Modulation and Demodulation	
Expt. 8	**Radio receiver Measurements-Selectivity, Sensitivity & Fidelity**
To Study the Parameters of Radio receiver Measurements like Selectivity, Sensitivity & Fidelity	
Expt. 9	**Simulation of Analog Modulation Technique using NI LABVIEW**
To Observe the Simulated Outputs of Analog Modulation Technique using NI LABVIEW	
Expt. 10	**DIGITAL COMMUNICATION**
Sampling theorem verification To Verify the Sampling Theorem for Sampling Frequency Less than or Greater than of Nyquist Rate	
Expt. 11	**Time Division Multiplexing**
To Study the Process of Sampling Frequency Variation and also Output Waveform of TDM	
Expt. 12	**Pulse Code Modulation**
To Study the Pulse Code Modulation and Demodulation	
Expt. 13	**Delta Modulation**
To Study the Construction of Delta Modulation Circuit, Observe the Output of Integrator	
Expt. 14	**Frequency shift Keying-Modulation & Demodulation**
To Construct FSK Modulator and Demodulator Circuit and their Operation	
Expt. 15	**Phase shift Keying-Modulation & Demodulation**
To Construct PSK Modulator and Demodulator Circuit and their Operation	

Expt. 16	Differential Phase shift Keying-Modulation & De modulation

To Construct DPSSK Modulator and Demodulator Circuit and their Operation

Expt. 17	QPSK-Modulation & Demodulation

To Construct QPSK Modulator and Demodulator Circuit and their Operation

Expt. 18	Simulation of Digital Modulation Technique using NI LABVIEW

Reference Books

1. Upamanyu Madhow, Cambridge University Press, 2008.
2. Herbert Taub & Donald L Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd Edition, 2009.

Web References

1. https://en.wikipedia.org/wiki/Data_transmission
2. https://nptel.ac.in/noc/individual_course.php?id=noc17-ec11

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: NI LabVIEW

HARDWARE: CRO, Function Generator, Communication Trainer Kits,Desktop Computers (04 nos)

Course Outcome

1. Compute and simulate analog modulation & demodulation techniques
2. Construct pre-emphasis and de-emphasis at the transmitter and receiver
3. Implement sampling theorem.
4. Implement different pulse analog modulation techniques.
5. Implement different base band data transmission techniques.
6. Implement different band pass data transmission techniques

MICROPROCESSORS AND MICROCONTROLLERS LABORTORY

B.Tech 6th Semester –Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16EC2613	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 39				Total Classes: 39		

OBJECTIVES

The course should enable the students to

I. Study the Architecture of 8085 & 8086 microprocessor.

II. Learn the design aspects of I/O and Memory Interfacing circuits.

III. Study the Architecture of 8051 microcontroller

LIST OF EXPERIMENTS

Expt. 1	**ARITHMETIC OPERATION – MULTI BYTE ADDITION AND SUBTRACTION, MULTIPLICATION AND DIVISION – SIGNED AND UNSIGNED ARITHMETIC OPERATION. ASCII – ARITHMETIC OPERATION- MULTI BYTE ADDITION AND SUBTRACTION, MULTIPLICATION AND DIVISION**

To study Arithmetic operation – Multi byte Addition and Subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation. ASCII – arithmetic operation- Multi byte Addition and Subtraction, Multiplication and Division

Expt. 2	**LOGIC OPERATIONS – SHIFT AND ROTATE – CONVERTING PACKED BCD TO UNPACKED BCD, BCD TO ASCII CONVERSION.**

To study Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.

Expt. 3	**BY USING STRING OPERATION AND INSTRUCTION PREFIX: MOVE BLOCK, REVERSE STRING, SORTING, INSERTING, DELETING, LENGTH OF THE STRING, STRING COMPARISON.**

To Study Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.

Expt. 4	**A) GENERATING THE FIBONACCI SERIES.** **B) ASCENDING ORDER OF N-8BIT NUMBERS.** **C) DESCENDING ORDER OF N-8BIT NUMBERS.**

To study Generating the Fibonacci series, Ascending order of N-8bit numbers,

Descending order of N-8bit numbers.

Expt. 5	**INTERFACING STEPPER MOTOR WITH 8086 MICROPROCESSOR** **A) CLOCKWISE 5 ROTATIONS** **B) ANTI CLOCKWISE 5 ROTATIONS**

To study Interfacing stepper motor with 8086 microprocessor

a) Clockwise 5 rotations

b) Anti clockwise 5 rotations

Expt. 6	**INTERFACING DAC WITH 8086 MICROPROCESSOR** **A) GENERATING TRIANGULAR WAVEFORM** **B) GENERATING SAW TOOTH WAVEFORM** **C) GENERATING SQUARE WAVEFORM**

To study Interfacing DAC with 8086 microprocessor

Expt.7	**VERIFICATION OF THE GIVEN STRING IS WHETHER PALINDROME OR NOT.**

To study Verification of the given string is whether palindrome or not.

Expt. 8	**READING AND WRITING ON A PARALLEL PORT.**
To study Reading and Writing on a parallel port	
Expt. 9	**TIMER IN DIFFERENT MODES.**
To study Timer in different modes.	
Expt. 10	**SERIAL COMMUNICATION IMPLEMENTA TION.**
To study Serial communication implementation.	
Expt. 11	**8259 – INTERRUPT CONTROLLER: GENERATE AN INTERRUPT USING 8259 TIMER.**
To study 8259 – Interrupt Controller: Generate an interrupt using 8259 timer	
Expt. 12	**8279 – KEYBOARD DISPLAY: WRITE A SMALL PROGRAM TO DISPLAY A STRING OF CHAR ACTERS.**
To study 8279 – Keyboard Display: Write a small program to display a string of characters.	
Expt. 13	**8255 – PPI: WRITE ALP TO GENERATE SINU SOIDAL WAVE USING PPI.**
To study 8255 – PPI: Write ALP to generate sinusoidal wave using PPI.	
Expt. 14	**8251 – USART: WRITE A PROGRAM IN ALP TO ESTABLISH COMMUNICATION BETWEEN TWO PROCESSORS.**
To study 8251 – USART: Write a program in ALP to establish Communication between two processors.	

Reference Books

1. Advanced Microprocessors and Peripherals, A.K. Ray and K.M. Bhurchandi , TMH
2. Microprocessors and Interfacing, Douglas V. Hall , II Edn ,TMH

Web References

1. https://www.electrical4u.com
2. https://www.researchgate.net

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS

SOFTWARE: Microprocessor and microcontroller kits

HARDWARE: Desktop Computers (05 nos)

Course Outcome

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

1. execute different arithmetic and logical operations using 8086 Micro processor
2. interface stepper motor and DAC to 8086 micro processor
3. interface the microcontroller 8051 with PPI, Keyboard

MINI PROJECT

B.Tech 6th Semester –Electronics & Communication Engineering								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
16EC2615	**Core**	-	-	-	2	25	50	75
Contact Classes: 36	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 36**		

OBJECTIVES

The course should enable the students to

I. Apply the programming knowledge into a real- world situation/problem and exposed the students how programming skills helps in developing a good engineer

II. The student should gain a thorough knowledge in the problem, he/she has selected and the language / software/Hardware, he/she is using.

The Mini Project shall be carried out during 6th Semester along with other lab courses by having regular weekly slots. Students will take mini project batch-wise and the batches will be divided as per the guidelines issued. The topic of mini project should be so selected that the students are enabled to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of mini project could be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with specific outcome.

Mini Project report will be evaluated for 75 marks. 25 marks for internal evaluation and 50 marks for external evaluation.

Assessment will be done by the supervisor/guide for 25 marks based on the work and presentation/ execution of the mini project.

The remaining 50 marks are based on report, presentation, execution and viva-voce. Evaluation is done by a committee comprising the mini project

supervisor, Head of the Department and external examiner appointed by the Principal from the panel of experts recommended by Chairman, BOS in consultation with Head of the Department.

Outcomes

1. Acquire practical knowledge within the chosen area of technology for project development
2. contribute as an individual or in a team in development of technical projects
3. develop effective communication skills for presentation of project related activities
4. identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach

TECHNICAL APTITUDE

B.Tech 6th Semester –Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16AS3601	-	-	-	-	1	25	50	75
Contact Classes: 36	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 36			

OBJECTIVES

The course should enable the students to

I. To ensure that students learn to think critically about mathematical models.

II. To ensure students in solving problems effectively and accurately.

III. Application of mathematical or statistical models to different real world contexts.

UNIT-I		Classes:5

Problem Solving in Commercial Mathematics

(Percentages, Profit and Loss, Discount and Interest)

UNIT-II		Classes:5

Problem Solving in advanced level of Mathematical Ability

(Ratio and Proportions, Mixtures, Time and Work, Time and Distance)

UNIT-III		Classes:7

C - language concepts

C language basics, Structure of a C Program, C Tokens, Variables, Constants, C functions, types, recursion, Header files, Preprocessor Commands, Storage Classes, Arrays, types of Arrays, Strings, Pointers, Structures.

UNIT-IV		Classes:8

Data Structures

Introduction, Stacks, Queues, types of Queues, Applications of Stacks and Queues, Linked Lists, Search Techniques: Linear Search, Binary Search, Sorting Techniques: Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Trees: basic terminology, Binary Trees, Binary Search Trees.

UNIT-V		Classes:11

Personality Development- Personal Grooming-Dressing, Body, Language, Leadership Skills, Basic Etiquettes, Mannerism / Confidence Building - Positive Attitude/ Mind Power Training etc

HR Fundamentals- Practice of self concept.

Kinds of Interviews –Structured Interview. A structured interview is typically formal and organized and may include several interviewers, commonly referred to as a panel interview. ...

Unstructured Interview. ...

Stress Interview. ...

Behavioral Interview. ...

Problem Solving or Case Interview. ...

Panel Interview. Required Key Skills – Corporate culture

Interview Skills - Mock Interviews [One –One, Panel, Telephonic & Skype]

Outcomes

1. Student can attempt different technical competitive exams.
2. Student can enhance technical ability and logical thinking.

PROFESSIONAL SOCIETY ACTIVITIES-IV

B.Tech 6th Semester –Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
16AS3602		L	T	P	C	CIA	SEE	Total
		-	-	-	1			
Contact Classes: 12	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 12			

OBJECTIVES

The course should enable the students to

1. Improve communication skills
2. Develop leadership qualities

Professional Society Activities (PSA) course is aimed at enhancing the self-learning, communication, managerial skills of the students by engaging them in various Co & Extra Curricular activities during their course of study. Activities in each of the department shall be designed and conducted by the Professional Society Executive Committee whose composition is:

1. Faculty Mentors- 2 No.
2. Student Chairman: 1 No.- Final year Student
3. Student General Secretary: 1 No.- Third year Student
4. Treasurer: 1 No.- Third year Student

Student Members: 2 No's from each class

PSA related activities would be of the following nature but not limited to:

Activity#1	Just A Minute
Activity#2	Technical Quiz
Activity#3	Open House- Lab Demo
Activity#4	Technical Paper Presentation- Preliminary
Activity#5	Technical Paper Presentation- Final
Activity#6	Poster Presentation
Activity#7	Collage- A theme based event

Activity#8	Debate Competition
Activity#9	Group Discussion Competition
Activity#10	Mock Interviews
Activity#11	Model Exhibition
Activity#12	Valedictory Function

ENGINEERING ECONOMICS AND PROJECT MANAGEMENT

B.Tech 6th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
16MB1411	Core	L	T	P	C	CIA	SEE	TOTAL
		3	-	-	3	40	60	100
Contact Classes:60	Tutorial Classes: -		Practical Classes: Nil			Total Classes:60		

OBJECTIVES

The course should enable the students to

1. Develop knowledge over contemporary economic aspects.
2. Create knowledge over market structures and production aspects
3. Develop knowledge over project management concepts and other issues.

UNIT -I	Introduction to Economics	Classes-15

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT -II	Demand & Market Structures	Classes-15

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand.Meaning of Market, Types of Market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition Meaning of production and factors of production, Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale.

UNIT -III	Project Management	Classes-15

Basics of Project Management: Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles.

UNIT -IV	Project Identification and Selection	Classes-15

Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point PERT and CPM: Introduction, Development of Project Network, Time Estimation, Determination of the Critical Path, PERT Model, Measures of variability, CPM Model, Network Cost System

Text Books

1. Managerial Economics-AR Arya Sree, Tata McGraw HILL
2. Gupta, “Managerial Economics”, TMH 2009
3. Management Science- AR Arya Sree, Tata Mc Graw HILL
4. Project Management-K Nagarajan

Reference Books

1. Joel Dean, Managerial Economics, PHI. Henry and Haynes, Managerial Economics (Analysis and Cases) Business Publications.

Web References

1. https://kantakji.com/media/175050/file1343.pdf

E-Text Books

1. https://ndl.iitkgp.ac.in/

Outcomes

At the end of the course students will be able to

1. Understand the concepts in economics related to demand and supply.
2. Know about the market structures and production functions.
3. Understand project management concept.
4. Do simple problems in PERT, CPM and crashing.
5. Understand the concepts of cost-profit analysis
6. Know the pricing strategies

MICROWAVE ENGINEERING

B.Tech 7th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1701	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: 10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To understand and gain complete knowledge about Microwave devices such as amplifiers, oscillators.

II. To understand and gain complete knowledge about Microwave Components.

III. To understand and gain complete knowledge about Microwave Measurements.

UNIT-I	MICROWAVE TRANSMISSION LINES	Classes:15

Introduction, Microwave spectrum and bands, applications ofMicrowaves. Rectangular Waveguides-Solution of Wave Equation in Rectangular Coordinates, TE/TM mode analysis, Expressions for fields, Characteristic equation and cutoff frequencies, filter characteristics, dominant and degenerate modes, sketches of TE and TM mode fields in the cross-section. Mode characteristics - Phase and Group velocities, wavelengths and impedance relations, Illustrative Problems.

Rectangular Waveguides – Power Transmission and PowerLosses, Impossibility of TEM Modes, Micro strip lines-introduction, Z_0 relations, effective dielectric constant, losses, Q-factor, Cavity resonators-introduction, Rectangular and cylindrical cavities, dominant modes and resonant frequencies, Q-factor and coupling coefficients, Illustrative Problems.

UNIT-II	WAVEGUIDE COMPONENTS AND APPLICATIONS	Classes:15

Coupling mechanisms- probe, loop, aperture types.Wave guide discontinuities - waveguide Windows, tuning screws and posts, matched loads. Waveguide attenuators - resistive card, rotary vane Attenuators; waveguide phase shifters-dielectric, rotary vane phase shifters. Wave guide multiport junctions-E plane and H plane Tees, Magic Tee, Directional couplers-2 hole, Bothe hole types, Illustrative Problems.

Ferrites-composition and characteristics, Faradayrotation; Ferrite components-Gyrator, Isolator, Circulator. Scattering Matrix-Significance, Formulation and properties. S Matrix calculations for 2-port junction, E plane and H plane Tees, Magic Tee, Directional coupler, circulator and Isolator, Illustrative Problems.

UNIT-III	MICROWAVE TUBES	Classes:15

Limitations and losses of conventional tubes at microwave frequencies.Microwave tubes-O type and M type classifications. O type tubes: 2 cavity klystrons-structure, Reentrant cavities, velocity modulation process and Applegate diagram, bunching process and small signal theory-Expressions for O/P power and efficiency. Reflex Klystrons-structure, Velocity Modulation, Applegate diagram, mathematical theory of bunching, power output, efficiency , oscillating modes and O/P characteristics, Effect of Repeller Voltage on Power O/P, Illustrative Problems.

HELIX TWTS: Significance, types and characteristics of slow wave structures; structure of TWT andamplification process (qualitative treatment), suppression of oscillations, gain considerations.

M -TYPE Tubes: Introduction, cross field effects, Magnetrons-different types, cylindrical travellingwave magnetron-Hull cutoff and Hartree conditions, modes of resonance and PI-mode operation, separation of PI-mode, O/P characteristics, Illustrative Problems.

UNIT-IV	MICROWAVE SOLID STATE DEVICES AND MEASUREMENTS	Classes:15

Microwave Solid State Devices: Introduction, classification, applications, Transfer Electronic Devices,Gunn diode - principles, RWH theory, characteristics, basic modes of operation - Gunn oscillation modes. LSA Mode, Varactor Diode, Parametric Amplifier, Introduction to Avalanche Transit time devices (brief treatment only).

Microwave Measurements: Description of Microwave bench-different blocks and their features,errors and precautions; Microwave power measurement-Bolometers, Measurement of attenuation, frequency standing wave measurements –measurement of low and high VSWR, cavity-Q, impedance measurements.

Text Books

1. Microwave devices and circuits-Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Microwave principles-Herbert J.Reich, J.G.Skalnik, P.F.Ordung and H.L.Krauss, CBS publishers and distributors, New Delhi, 2004.

Reference Books

1. Foundations for microwave engineering-R.E.Collin, IEEE press, John Wiley, 2nd edition, 2002.
2. Microwave circuits and passive devices-M.L.Sisodia and G.S.Raghuvanshi,Wiley Eastern Ltd., New age International publishers Ltd., 1995.

Web References

1. https://onlinelibrary.wiley.com/doi/book/10.1002/0471654507
2. https://ieeexplore.ieee.org/book/5265446

E-Text Books

1. S. Vasuki, D. Margaret Helena, and R. Rajeswari, McGraw Hill Education (India) Private Limited.

Outcomes

1. **Test** the characteristics of Gunn diode
2. **Test** the characteristics of reflex klystron .
3. **Examine** the scattering parameters of directional coupler
4. **Examine** the parameters of waveguide
5. **Examine** the characteristics of digital optical fiber
6. **Find** the radiation pattern of antenna

EMBEDDED SYSTEMS

B.Tech 7th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1702	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: 10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To provide in depth knowledge about embedded processor, its hardware and software to understand and gain complete knowledge about Microwave Components.

II. To explain programming concepts and embedded programming in C and assembly language.

III. To explain real time operating systems, inter-task communication and an embedded software development tool.

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes:15

Introduction, design challenges, processor technology, IC technology, design technology, tradeoffs, single purpose processor, RT level combinational logic, sequential logic (RT level) custom single purpose processor design, optimizing custom single purpose processors. General purpose processors: basic architecture, pipelining, programmers view, development environment, ASIPS, microcontrollers and digital signal processors

UNIT-II	STATE MACHINE AND CONCURRENT PROCESS MODEL	Classes:15

Models vs. languages, FSMD, using state machines, PSMM, concurrent process model, concurrent processes, communication and synchronization among processes, data flow model and real-time systems. Need for communication interfaces, RS232/UART, RS422/RS485, USB, Infrared, IEEE 802.11, and Bluetooth.

UNIT-III	BASIC EMBEDDED SYSTEMS AND RTOS CONCEPTS	Classes:15

Architecture of kernel, tasks and task scheduler, interrupt service routines, semaphores, mutex. Mail boxes, message queues, event registers, pipes and signals.

UNIT-IV	ADVANCED EMBEDDED SYSTEMS AND RTOS CONCEPTS	Classes:15

Timers, memory management, priority inversion problem, embedded OS and real time OS, RT Linux, and Handheld OS. HW / SW co- design.

Text Books

1. Frank Vahid, Tony D Givargis, Embedded system design – A unified HW/ SW Introduction, JohnWiley & sons 2002.
2. KVKK Prasad, Embedded and real time systems, Dreemtech Press, 2005.

Reference Books

1. Raj Kamal, Embedded system architecture, programming and design, TMH edition.
2. Mohammad Ali Mazidi, Janice G., The 8051 microcontroller and embedded systems, Pearson edition.

Web References

1. https://www.oreilly.com/library/view/embedded-systems-architecture/9780123821966/
2. http://esd.cs.ucr.edu/

E-Text Books

1. K. Tanaka, Embedded Systems- Theory and Design Methodology, Intech Open
2. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, Second Edition, MIT Press, 2017.

Outcomes

1. **Describe** the design methodology of embedded system
2. **Distinguish** various computational models
3. **Explain** the architecture of kernel and its objects
4. C**lassify** embedded operating systems
5. **Discuss** the architecture of general purpose processor
6. **Implement** the communication interfaces for embedded applications

DIGITAL IMAGE PROCESSING (Elective – II)

B.Tech 7th Semester: Electronics & Communication Engineering (Open Elective)								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1707	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil			Total Classes:60			

OBJECTIVES

The course should enable the students to

I. To study the image fundamentals and mathematical transforms necessary for image processing

II. To study the image enhancement techniques

III. To study image restoration procedures.

IV. To study the image compression procedures.

UNIT-I	DIGITAL IMAGE FUNDAMENT-\ ALS & IMAGE TRANSFORMS	Classes:15

Image Sensing and Acquisition, Image Sampling & quantization, somebasic Relationships between pixels. Mathematical tools used in digital image processing – array Vs matrix operations, linear Vs non linear operations, arithmetic operations, set and logical operations, spatial operations, vector and matrix operations, Probabilistic methods. 2D-DFT and properties, Walsh Transform, Hadamard Transform, Discrete cosineTransform, Haar-Transform, Slant Transform, KL transform, comparison of different image transforms.

UNIT-II	IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN & IMAGE ENHANCEMENT IN FREQUENCY DOMAIN	Classes:15

Basic Intensity transformations functions, histogramProcessing, fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening spatial filters,Combining spatial enhancement methods. Basics of filtering in frequency domain, additionalcharacteristics of the frequency domain, corre-

spondence between filtering in the spatial and frequency domains. Image smoothing using frequency domain filters, image sharpening using frequency domain filters – Gaussian High pass filters, Laplacian in the frequency domain, Homomorphic filtering.

UNIT-III	IMAGE DEGRADATION/ RESTORATION & IMAGE SEGMENTATION	Classes:15

Noise models, Restoration in the presence of Noise only-spatialfiltering, -mean, order- statistic and adaptive filters, Estimating the Degradation function, Inverse filtering, Weiner filtering, Constrained Least squares filtering. Point, line and edge Detection, Thresholding, Region based segmentation, theuse of motion in segmentation.

UNIT-IV	IMAGE COMPRESSION & COLOR IMAGE PROCESSING	Classes:15

Need for Image compression, Classification of Redundancy in Images, Imagecompression models, Classification of image compression schemes, Run length coding, arithmetic coding, Block truncation coding, Dictionary based compression, transform based compression, Image compression standards, Scalar quantization, vector quantization. Color models, pseudo color image processing, color transformations,Smoothing and sharpening, image segmentation based on color.

Text Books

1. Digital Image Processing-R. C .Gonzalez & R.E. Woods, Addison Wesley/Pearson education, 3rd Edition, 2010.
2. Digital Image processing– S jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.

Reference Books

1. Digital Image processing using MATLAB-Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, Tata McGraw Hill, 2010.
2. Fundamentals of Digital Image processing-A .K. Jain, PHI.

Web References

1. https://web.cs.hacettepe.edu.tr/~erkut/bbm413.f16/index.html
2. https://nptel.ac.in/syllabus/syllabus_pdf/106105032.pdf

E-Text Books

1. http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20 Gonzalez %2C% 20 R.% 20 Woods - ilove pdf -compressed. pdf
2. http://een.iust.ac.ir/profs/Beheshti/Digital%20Image%20Processing/Addison%20Wesley%20%20 Digital %20 Image %20 Processing, %203rd%20 Edition. pdf

Outcomes

1. Understand the fundamental concepts of Digital Image Processing
2. Explain images in the frequency domain using various transforms
3. Examine the techniques for image enhancement & image restoration
4. Categorize various image compression techniques and compression standards
5. Discuss various image segmentation techniques
6. Understand the basic concepts of color image processing.

ELECTRONIC PRODUCT DESIGN & PACKAGING (Elective –II)

B.Tech 7th Semester: Electronics & Communication Engineering (Open Elective)								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1708	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. Communication in an intelligible English accent and pronunciation.

II. Introduce students' elements of Grammar and Composition of English language.

III. Maintain linguistic competence through training in vocabulary, sentence structures.

UNIT-I	INTRODUCTION TO ELECTRONIC PRODUCT DESIGN	Classes:15

Man machine dialog and Industrial design, user-centered design, five element of successful design, cognition, ergonomics. Packaging and factors, design for manufacture, assembly and disassembly, wiring, temperature, vibration and shock. Safety, noise, energy coupling, grounding, filtering and shielding.

UNIT-II	HARDWARE DESIGN&TESTING METHODS	Classes:15

Design process. Identifying the requirements, formulating specifications, design specifications, Specifications verses requirements, System partitioning, Functional design, architectural design, Functional model verses architectural model. Prototyping. Performance and Efficiency measures. Formulating a test plan, writing specifications, Test procedure and test cases, Egoless design, design reviews. Module debug and test: black box test, white box test, grey box test.

UNIT-III	SOFTWARE DESIGN AND TESTING METHODS & PCB DESIGN	Classes:15

Types of Software. Waterfall model of software development. Models, metrics and software limitations. Risk abatement and failure preventions. Software bugs and testing. Good programming practice. User interface .Embedded, Real time software. Fundamental Definitions, Standards. Routing Topology Configurations, Layer Stack up assignment, Grounding Methodologies, Aspect Ratio, Image Planes, Functional Partitioning, Critical frequencies, Bypassing and decoupling. Design techniques for ESD Protection, Guard Band implementation.

UNIT-IV	PRODUCT DEBUGGING AND TESTING & DOCUMENTATION	Classes:15

Steps of Debugging, Techniques for troubleshooting, characterization, Electromechanical components, passive components, active components, active devices, operational amplifier, Analog-Digital Conversion, Digital Components, Inspection and test of components, Simulation, Prototyping and testing, Integration, validation and verification. EMI & EMC issues. Definition, need, and types of documentation. Records, Accountability, and Liability. Audience. Preparation, Presentation, and Preservation of documents. Methods of documentation, Visual techniques, Layout of documentation, Bill of material.

Text Books

1. Kim Fowler," Electronic Instrument Design" Oxford university press.
2. Robert J. Herrick, "Printed Circuit board design Techniques for EMC Compliance", Second edition, IEEE press.

Reference Books

1. James K. Peckol, "Embedded Systems – A Contemporary Design Tool", Wiley publication 2. J C Whitakar," The Electronics Handbook", CRC press.
2. J C Whitakar," The Electronics Handbook", CRC press

Web References

1. https://nptel.ac.in/courses/108108031/

E-Text Books

1. https://nptel.ac.in/courses/108108031/module1/Lecture02.pdf
2. https://www.esdmindia.in/sites/default/files/Brochure_DEPD_APR_2018__new.pdf

Outcomes

1. Describe the basics of electronic product design methodology
2. Explain hardware design process and testing methods
3. Discuss software design process and testing methods
4. Recognize PCB design process
5. Identify product debugging and testing techniques
6. State the importance of documentation.

BIO-MEDICAL INSTRUMENTATION (Elective – II)

B.Tech 7th Semester: Electronics & Communication Engineering (Open Elective)								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1709	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. Communication in an intelligible English accent and pronunciation.

II. Introduce students' elements of Grammar and Composition of English language.

III. Maintain linguistic competence through training in vocabulary, sentence structures.

UNIT-I	MEDICAL INSTRUMENTATION SYSTEM	Classes:15

Components of Medical Instrumentation System, Bio – amplifier, Static and dynamic characteristics of medical instruments, Biosignals and characteristics, Problems encountered with measurements from human beings.Organisation of cell, Derivation of Nernst equation for membrane Resting Potential Generation and Propagation of Action Potential, Conduction through nerve to neuro-muscular junction.

UNIT-II	ELECTRODES & POTENTIALS	Classes:15

Bio Electrodes – Biopotential Electrodes-External electrodes, Internal Electrodes, Biochemical Electrodes.Mechanical function, Electrical Conduction system of the heart, Cardiac cycle, Relation between electrical and mechanical activities of the heart.

UNIT-III	MEASUREMENT & BLOOD FLOW	Classes:15

Cardiac Instrumentation Blood pressure and Blood flow measurement, Specification of ECG machine, Einthoven triangle, Standard 12-lead configurations, Interpretation of ECG waveform with respect to electro mechanical activity of the heart, Therapeutic equipment, Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine, Neuro-Muscular Instrumentation Specification of EEG and EMG machines, Electrode placement for EEG and EMG recording, Interpretation of EEG and EMG.

UNIT-IV	RESPIRATION & HAZARDS	Classes:15

Respiratory Instrumentation Mechanism of respiration, Spirometry, Pnemuotachograph Ventilators. Patient electrical safety, types of hazards, natural protective mechanism, leakage current, patient isolation, hazards in operation rooms, grounding conditions in hospital environment.

Text Books

1. Biomedical Instrumentation and Measurements – Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, PHI, 2nd Ed, 1980.
2. Medical Instrumentation, Application and Design – John G. Webster, John Wiley, 3rd Ed., 1998.

Reference Books

1. Principles of Applied Biomedical Instrumentation – L.A. Geoddes and L.E. Baker, John Wiley, 1975.
2. Hand-book of Biomedical Instrumentation – R.S. Khandpur, TMH, 2nd Ed., 2003.

Web References

1. https://www.accessengineeringlibrary.com/browse/handbook-of-bio-medical-instrumentation-third-edition
2. https://kundoc.com/pdf-handbook-of-biomedical-instrumentation-and-measurement-.html

E-Text Books

1. http://www.robots.ox.ac.uk/~gari/teaching/b18/lecture_slides/B18_LectureA.pdf
2. https://www.egr.msu.edu/classes/ece445/mason/Files/2-Basics_ch1.pdf

Outcomes

1. Explain the components of biomedical instrumentation system
2. Describe the functioning of various bioelectrodes
3. .Discuss the operation of ECG machine
4. Demonstrate the working of EEG and EMG machines
5. Examine the respiratory instrumentation system
6. Classify various hazards and protective mechanisms.

DSP PROCESSORS AND ARCHITECTURES (Elective – III)

B.Tech 7th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1703	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: 10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To provide in?depth knowledge about embedded processor, its hardware and software to understand and gain complete knowledge about Microwave Components.

II. To explain programming concepts and embedded programming in C and assembly language.

III. To explain real time operating systems, inter-task communication and an embedded software development tool.

UNIT-I	INTRODUCTION TO PROGRAMMABLE DSPs	Classes:15

Multiplier & Multiplier accumulator, Modified bus structures & memory access schemes in P – DSPs, Multiple access memory, Multi ported memory, VLIW architecture, Pipelining, Special addressing modes in P–DSPs, On chip peripherals.

Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT-II	PROGRAMMABLE DIGITAL SIGNAL PROCESSOR	Classes:15

Architectures for Programmable DSP Devices: 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.

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors, Architecture of TMS 320C67XX Processor.

UNIT-III	INTRODUCTION AND IMPLEMENTATION OF DSP ALGORITHMS	Classes:15

Implementations of Basic DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

Implementation of FFT Algorithms: An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

UNIT-IV	RECENT TRENDS IN DSP SYSTEM DESIGN	Classes:15

Interfacing Memory And I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

Recent Trends in DSP System Design: An over-view of the application nodes on DSP systems, An over-view of open multimedia applications platform (OMAP), An Introduction to FPGA, Design flow for an FPGA based system design, Cad tools for FPGA based system design, soft core processors, FPGA based DSP system design, New algorithms for Implementa-

tion of filters in VLSI, Distributed arithmetic algorithm, Case studies, Comparison of the performances of the systems designed using FPGAs and digital signals processors.

Text Books

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M. Bhaskar, TMH, 2004.

Reference Books

1. Digital Signal Processing – Jonathan Stein, John Wiley, 2005.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

Web References

1. https://www.kdkce.edu.in/pdf/DSP_ Processor___ Architecture_ compressed. pdf
2. http://www.smdp2vlsi.gov.in/smdp2vlsi/downloads/ICDSP Micro processor Arch.pdf

E-Text Books

1. B. Venkataramani and M. Bhaskar, Digital Signal Processors Architecture, Programming and Applications, McGraw Hill Education.
2. Sen-Maw Kuo, Woon-Seng Gan, Digital Signal Processors Architecture, Implementation and Applications, Pearson, Prentice Hall.

Outcomes

1. **Explain** the basic characteristics of programmable DSP's.
2. **Analyze** computational accuracy in DSP implementations.
3. **Discuss** the architectural features of P-DSP's.
4. **List** out the features of TMS320C54XX processor.
5. **Plan** the basic DSP algorithms implementation.
6. **Discuss** the interfacing with CODEC and list out recent system design methods.

WIRELESS COMMUNICATION AND NETWORKS (Elective -III)

B.Tech 7th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1704	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: 10	Practical Classes: Nil			Total Classes:60			

OBJECTIVES

The course should enable the students to

I. To provide an overview of Wireless Communication networks area and its applications in communication engineering.

II. To appreciate the contribution of Wireless Communication networks to overall technological growth.

III. To understand the various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks.

UNIT-I	INTRODUCTION TO WIRELESS NETWORKING	Classes:15

Introduction to Wireless Networking: Introduction, Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic routing in wireless networks.

Multiple Access Techniques for Wireless Communication: Introduction, FDMA, TDMA, Spread Spectrum, Multiple Access, SDMA, Packet radio, Packet radio protocols, CSMA protocols, Reservation protocols.

UNIT-II	WIRELESS DATA SERVICES	Classes:15

CDPD, ARDIS, RMD, Common channel signaling, ISDN, BISDN and ATM, SS7, SS7 user part, signaling traffic in SS7.

Mobile IP and Wireless Access Protocol: Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling, WAP Architecture, overview, WML scripts, WAP service, WAP session protocol, wireless transaction, Wireless datagram protocol.

UNIT-III	WIRELESS TECHNOLOGIES	Classes:15

Infrared LANs, Spread spectrum LANs, Narrow bank microwave LANs, IEEE 802 protocol Architecture, IEEE802 architecture and services, 802.11 medium access control, 802.11 physical layer.

Blue Tooth: Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol. Introduction to WLL Technology.

UNIT-IV	MOBILE DATA NETWORKS	Classes:15

Introduction, Data oriented CDPD Network, GPRS and higher data rates, Short messaging service in GSM, Mobile application protocol.

Wireless ATM & Hiper LAN: Introduction, Wireless ATM, HIPERLAN, Adhoc Networking and WPAN.

Text Books

1. Wireless Communications, Principles, Practice – Theodore S. Rappaport, PHI, 2nd Ed., 2002.
2. Wireless Communication and Networking – William Stallings, PHI, 2003.

Reference Books

1. Wireless Digital Communications – Kamilo Feher, PHI, 1999.
2. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, Pearson Education, 2002.

Web References

1. http://ee.sharif.edu/~pr.wireless.comm/references/Goldsmith.pdf
2. http://ee.sharif.edu/~pr.wireless.comm/references/Schwartz.pdf

E-Text Books

1. G.L. Stuber, Principles of Mobile Communications, Kluwer Academic, 1996.
2. T.S. Rappaport, Wireless Communications: Principles and Practice, Prentice Hall, 2002.

Outcomes

1. **Identify** the different Multiple accessing technologies.
2. **Discuss** the basics of wireless Networking.
3. **Discuss** about Mobile IP and Wireless Access Protocol.
4. **Discuss** about Wireless LAN Technologies.
5. **Examine** the Bluetooth technologies.
6. **Compare** different methods of data transfers.

OPTICAL COMMUNICATIONS (Elective – III)

B.Tech 7th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1705	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: 10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To learn the basic elements of optical fiber transmission link, fiber modes, configurations and structures.

II. To understand the different kind of losses, signal distortion, SM fibers.

III. To learn the various optical sources, materials and fiber splicing

IV. To learn the fiber optical receivers and noise performance in photo detector.

UNIT-I	INTRODUCTION TO OPTICAL FIBER WAVEGUIDES	Classes:15

Historical Development, The General System, Advantages of Optical Fiber Communications, Ray Theory transmission, Electromagnetic mode theory for Optical Propagation, Cylindrical Fiber.

Single mode fibers, Fiber Materials: Fiber Fabrication, Mechanical Properties of Fibers, Fiber Optic Cables.

UNIT-II	SIGNAL DEGRADATION OPTICAL FIBRES	Classes:15

Attenuation, Material Absorption Losses in Silica Glass Fibers, Linear Scattering Losses, Fiber Bend Loss, Dispersion, Chromatic dispersion, Intermodal dispersion, Overall fiber dispersion, Polarization. Fiber alignment and joint loss, Fiber Splices, Fiber Connectors, Fiber Couplers, Optical Isolators and Circulators.

UNIT-III	LEDs, POWER LAUNCHNG AND COUPLING	Classes:15

LED Structures, Light Source Materials, Quantum efficiency and LED Power, Modulation of LED. LASER Diodes- Laser Diode Modes and Threshold Conditions, Laser Diode Rate Equations, External Quantum Efficiencies, Resonant Frequencies.

Source to Fiber Power Launching, Lensing schemes for Coupling Improvement, fiber-to-fiber Joints, LED coupling tot single mode fibers, Fiber Splicing, Optical fiber connectors. Photo Detectors – Physical principles of photo diodes, photo detector noise, detector response time, avalanche multiplication noise, structures for InGaAs APDs, temperature effect on avalanche gain, comparisons of photo detectors.

UNIT-IV	DIGITAL AND ANALOG LINKS	Classes:15

Digital Links: Point to point links, power penalties, error control.

Analog links: Over-view of analog links, carrier to noise ratio, multichannel transmission techniques, RF over fiber, radio over fiber links.

WDM Concepts and components: Over-view, Passive optical couplers, Isolators & circulators, Fiber grating filters, dielectric thin film filters, Phased array based devices, Diffraction gratings, Active optical components, tunable light sources.

Text Books

1. Optical fiber communications- Gerd keiser, McGraw Hill International Edition, 4th Edition, 2010.
2. Optical fiber communications-John M. Senior, PHI, 3rd Edition, 2010.

Reference Books

1. Principles and Applications of Optical Communications, Max Ming-Kang Liu, TMH, 2010.
2. Text book on optical fiber communication and its applications-S.C.Gupta, PHI, 2005.

Web References

1. https://en.wikipedia.org/wiki/Fiber-optic_communication
2. https://onlinelibrary.wiley.com/doi/abs/10.1002/0471219282.eot158

E-Text Books

1. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3rd Edition, 2008.
2. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

Outcomes

1. **Describe** the fundamentals of ray theory transmission within fiber.
2. **Identify** different types of fibers and their propagation techniques.
3. **Explain** about splicers, isolators and couplers.
4. **Classify** the different losses in fiber, optical sources and receivers.
5. **Design** an optical communication system by estimating power launching and coupling capabilities.
6. **Describe** about advanced optical links and components.

AVAILABLE SELECTED MOOCS (Elective – III)

B.Tech 7th Semester: Electronics &Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
16EC1706	Core	L	T	P	C	CIA	SEE	TOTAL
		3	1	-	3	40	60	100
Contact Classes: -	Tutorial Classes: -		Practical Classes: Nil			Total Classes: -		

Meeting with the global requirements, to inculcate the habit of self learning and incompliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion for the course from the MOOCs providers

Regulations for MOOCs

- The respective departments shall give a list from NPTEL or any other standard providers, whose credentials are endorsed by the HOD.
- Each department shall appoint Coordinators/Mentors and allot the stu dents to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same.
- A student shall choose an online course (relevant to his/her programme of study) from the given list of MOOCs providers, as endorsed by the teacher concerned, with the approval of the HOD.
- The details of MOOC(s) shall be displayed in Grade card of a student, provided he/she submits the proof of completion of it to the department concerned through the Coordinator/Mentor.
- Student can get certificate from SWAYAM/NPTEL or any other stan dard providers, whose credentials are endorsed by the HOD. The course work should not be less than 12 weeks or student may appear for end examination conducted by the Institute.
- There shall be one Mid Continuous Internal Examination (Quiz exam for 40 marks) after 9 weeks of the commencement of the course and semester end examination (Descriptive exam for 60 marks) shall be done along with the other regular courses.

Three credits will be awarded upon successful completion of each MOOC courses having minimum of 8 weeks duration.

MICROWAVE ENGINEERING LABORATORY

B.Tech 7th Semester – Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16EC2709	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES

The course should enable the students to

I. To provide in?depth knowledge about embedded processor, its hard ware and software to understand and gain complete knowledge about Microwave Components.

II. To explain programming concepts and embedded programming in C and assembly language.

III. To explain real time operating systems, inter-task communication and an embedded software development tool.

LIST OF EXPERIMENTS

Expt. 1	**Gunn Diode Characteristics**

To study the V-I Characteristics of Gunn Diode

Expt. 2	**Reflex Klystron Characteristics**

To study the V-I Characteristics of Reflex Klystron System

Expt. 3	**Vswr Measurement**

To Determine the Standing Wave Ratio and Reflection Co-efficient

Expt. 4	**Impedance Measurement**

To Measure the Waveguides for Directional Coupler and Magic Tee

Expt. 5	**Waveguide Parameters Measurement**

To Measure Cut-off Wavelength, Guided Wavelength, Phase Velocity and Characteristic Impedance of Waveguide

Expt. 6	**Directional Coupler Characteristics**
To Study the Characteristics of Directional Coupler	
Expt. 7	**Scattering Parameters Of Directional Coupler**
To Study the Scattering Parameters of Directional Coupler	
Expt. 8	**Scattering Parameters Of Magic Tee**
To Study the Scattering Parameters of Magic Tee	
Expt. 9	**Radiation Pattern Of Horn Antenna**
To Observe the Radiation Pattern of Horn Antenna	
Expt. 10	**Data Rate For Digital Optical Link**
To Measure the Data Rate of Digital Optical Link	
Expt. 11	**Characteristics Of Laser Diode**
To Study the Characteristics of Directional Coupler	
Expt. 12	**Measurement Of Numerical Aperture**
To Measure the Numerical Aperture Characteristics	
Expt. 13	**Intensity Modulation Of Laser Output Through An Optical Fiber**
To Study the Intensity Modulation on Output of Laser with Optical Fiber	

Reference Books

1. Foundations for microwave engineering-R.E.Collin, IEEE press, John Wiley, 2nd edition, 2002.
2. Circuits and passive devices-M.L.Sisodia and G.S.Raghuvanshi,Wiley Eastern Ltd., New age International publishers Ltd., 1995.

Web References

1. https://onlinelibrary.wiley.com/doi/book/10.1002/0471654507
2. https://ieeexplore.ieee.org/book/5265446

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: NIL

HARDWARE: Reflex Klystron, Gunn Diode, VSWR, Electronic Components.

Course Outcome

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

1. **Test** the characteristics of Gunn diode.
2. **Test** the characteristics of reflex klystron .
3. **Examine** the scattering parameters of directional coupler.
4. **Examine** the parameters of waveguide.
5. **Examine** the characteristics of digital optical fiber.
6. **Find** the radiation pattern of antenna.

INSTRUMENTATION AND MEASUREMENTS LABORATORY

B.Tech 7th Semester – Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16EC2710	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 68				Total Classes: 68		

OBJECTIVES

The course should enable the students to

I. To provide a brief knowledge of measurements and measuring instruments related to engineering.

II. To give the sufficient information of measurements in any kind of industry viz. electrical, electronics, mechanical etc.

LIST OF EXPERIMENTS

Expt. 1	**Speed Measurement Using** **(A) Photoelectric Pickup Method** **(B) Magnetic Pickup Method**

To study the characteristics of speed measurement using pickup methods

Expt. 2	**Angular Displacement Measurement Using Capacitive Pickup Method**

To study angular displacement using capacitive pickup method

Expt. 3	**Measurement of Unknown Frequency and Phase Angle using Lissajous Patterns**

To Determine the unknown frequency and phase angle using **Lissajous Patterns**

Expt. 4	**LCR Q Meter**

To study the characteristics of LCR Q Meter

Expt. 5	**(A)Temperature Measurement Using Thermocouple** **(B) Resistance Temperature Detector (R.T.D.)**

To Measure temperature using thermocouple and resistor

Expt. 6	**Measurement of Capacitance using CRO**
To measure the value of unknown capacitance	
Expt. 7	**Illumination Characteristic Of Given Phototransistor**
To Obtain Input and Output Characteristics of Photo Transistor	
Expt. 8	**Calibration and Study of DMM**
To Study the Block wise Construction and the Calibration of DMM	
Expt. 9	**Displacement Measurement Using LVDT**
To Measure Displacement using LVDT	
Expt. 10	**Measurement of Strain Using Strain Gauge**
To Measure the Strain in Metal Conduction by using Strain Gauge	
Expt. 11	**Anderson Bridge**
To measure the unknown values of Inductance	
Expt. 12	**Schering Bridge**
To measure the unknown values of capacitance	
Expt. 13	**Characteristics of Thermistor**
To observe negative resistance region of thermistor	
Expt. 14	**Data Acquisition System**
To Study and Acquire Data from Control System	

Reference Books

1. Electrical and Electronics measurement and measuring instrument by DhanpatRai Publication
2. Electronic Instrumentation Technology by MMS Anand, PHI Pvt. Ltd., New Delhi Ed. 2005.
3. Electronics Instrumentation by H.S. Kalsi TMH Ed. 2004.

Web References

1. http://kgr.ac.in/beta/wp-content/uploads/2018/09/III-I-EEE-EMI.pdf

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS:

SOFTWARE: LabVIEW

HARDWARE: Desktop Computers (04 nos)

Course Outcome

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

1. Demonstrate basic measurement concepts of electronic measurements.
2. Learn the Importance of signal generators and signal analyzers in measurements.
3. Know relevance of digital instruments in measurements and need for data acquisition systems.
4. Know measurement techniques in optical domains.

DSP AND EMBEDDED SYSTEMS LABORATORY

B.Tech 7th Semester – Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16EC2711	Core	-	-	3	2	25	50	75
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36			Total Classes: 36			

OBJECTIVES

The course should enable the students to

I. To provide in?depth knowledge about embedded processor, its hardware and software to understand and gain complete knowledge about Microwave Components.

II. To explain programming concepts and embedded programming in C and assembly language.

III. To explain real time operating systems, inter-task communication and an embedded software development tool.

LIST OF EXPERIMENTS

Expt. 1	**Write A Matlab Program For Low Pass And High Pass Butterworth Filter Of 6th Order, 0.1 Hz 3db Cutoff Frequency And Sample Interval Of 50 Hz**

To Observe the Output Characteristics of LPF and HPF Butterworth Filter

Expt. 2	**Write A Matlab Program For Low Pass And High Pass Chebyshev Filter Of 8th Order, 0.1 Hz 3db Cutoff Frequency And Sample Interval Of 50 Hz**

(a) To Observe the Output Characteristics of LPF and HPF Chebyshev Filter

Expt. 3	**Study The Architecture Of Dsp Kit Ti6713**

(b) To Study the Architecture of DSP Kit

Expt. 4	**Write A Matlab Program To Evaluate Linear Convolution Of A Sequence. Implement The Same And Observe The Result On Dsp Kit**

(c) To Write a Program for Linear Convolution and to Determine its Output

Expt. 5	**Write A Matlab Program To Evaluate Circular Con volution Of A Sequence. Implement The Same And Observe The Result On Dsp Kit**
(d) To Write a Program for Circular Convolution and to Determine its Output	
Expt. 6	**Write A Matlab Program To Evaluate Psd Of A Digi tal Function. Implement The Same And Observe The Result On Dsp Kit**
To Write a Program for Power Spectral Density and to Determine its Output	
Expt. 7	**Write a keil assembly level program to perform ad dition of two numbers and run it using keil debugger.**
Addition of two numbers will be executed using keil debugger	
Expt. 8	**Write a keil assembly level program to toggle the bits of a port and run it using keil debugger.**
Toggle of bits will be executed using keil debugger	
Expt. 9	**Study the architecture of 8051 RTOS kit.** **(a) Write a program for toggling the LED's of RTOS 8051 kit.** **(b) Write a program for LCD interfacing and display of data using the RTOS 8051 kit.**
To Study the architecture of 8051 RTOS kit	
Expt. 10	**Study the architecture of PIC development board.** **(a) Write a program to interface seven segment display using PIC board.** **(b) Write a program to dump data over the serial in terface of PIC kit.**
To Study the architecture of PIC development board.	
Expt. 11	**Study the architecture of ARM development board.**
To Study the architecture of ARM development board.	

Reference Books

1. Digital Signal Processing – Jonathan Stein, John Wiley, 2005.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley etal. S. Chand & Co, 2000.

Web References

1. https://www.kdkce.edu.in/pdf/DSP_ Processor___ Architecture _compressed. pdf
2. http://www.smdp2vlsi.gov.in/smdp2vlsi/downloads/ICDSP Microprocess or Arch.pdf

Course Home Page

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS

SOFTWARE: MATLAB R2015a

HARDWARE: Desktop Computers (36 nos)

Course Outcome

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

1. Execute MATLAB programs for low pass & high pass filters.
2. Execute MATLAB programs for convolution of sequence.
3. Execute MATLAB programs for power spectral density
4. Execute basic applications using RTOS 8051 kit
5. Execute basic applications using PIC
6. Demonstrate the architecture of ARM processor

INTERNSHIP

B.Tech 7th Semester –Electronics & Communication Engineering								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
16AS3701	Core	-	-	-	2	25	-	25
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 68				Total Classes: 68		

OBJECTIVES

The course should enable the students to

I. Assist the student's development of employer-valued skills such as teamwork, communications and attention to detail

II. Expose the student to the environment and expectations of performance on the part of accountants in professional accounting practice, private/public companies or government entities.

III. Expose the student to professional role models or mentors who will provide the student with support in the early stages of the internship and provide an example of the behaviors expected in the intern's workplace.

There shall be 60 hours duration to complete summer internship during summer vacations. The total internal weightage for internship course is 25 marks and will be evaluated based on day to day assessment by concern industry.

The external examination shall be evaluated by the two senior faculties (i.e one faculty act as external examiner and other one as internal examiner) for 50 marks based on the his/her report and presentation

Course Outcome

1. An internship motivate you to create opportunities, embrace new ideas, and give direction to positive change
2. Enhance some of the skills that are transferable to any professional work setting.
3. Applied your knowledge, skills, experience to a work environment
4. Developed self-understanding, self-discipline, maturity and confidence.
5. Reflected on the content and process of the learning experience

PROFESSIONAL ACTIVITIES-V

B.Tech 7th Semester: Electronics & Communication Engineering								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
16AS3702	-	-	-	-	1	-	-	-
Contact Classes: 12	**Tutorial Classes: Nil**		**Practical Classes: Nil**			**Total Classes: 12**		

OBJECTIVES

The course should enable the students to

1. Improve communication skills
2. Develop leadership qualities

Professional Society Activities (PSA) course is aimed at enhancing the self-learning, communication, managerial skills of the students by engaging them in various Co & Extra Curricular activities during their course of study. Activities in each of the department shall be designed and conducted by the Professional Society Executive Committee whose composition is:

1. Faculty Mentors- 2 No.
2. Student Chairman: 1 No.- Final year Student
3. Student General Secretary: 1 No.- Third year Student
4. Treasurer: 1 No.- Third year Student

Student Members: 2 No's from each class

PSA related activities would be of the following nature but not limited to:

Activity#1	Just A Minute
Activity#2	Technical Quiz
Activity#3	Open House- Lab Demo

Activity#4	Technical Paper Presentation- Preliminary
Activity#5	Technical Paper Presentation- Final
Activity#6	Poster Presentation
Activity#7	Collage- A theme based event
Activity#8	Debate Competition
Activity#9	Group Discussion Competition
Activity#10	Mock Interviews
Activity#11	Model Exhibition
Activity#12	Valedictory Function

CELLULAR AND MOBILE COMMUNICATION (Elective – IV)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1801	Core	3	1	-	3	40	60	100
Contact Classes:51	Tutorial Classes: -9	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To provide the students with an understanding of the cellular concept frequency reuse, handoff strategies.

II. To enable the students to analyze and understand wireless and mobile cellular communication systems over stochastic fading channels.

III. To provide the students with an understanding of Co-channel and Non-Co channel Interference. To give students an understanding of cell coverage for signal and traffic diversity techniques and mobile antennas.

IV. To give the students an understanding of frequency management channel assignment and types of handoff.

UNIT-I	CELLULAR MOBILE RADIO SYSTEMS & ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN	Classes:15

Introduction to Cellular Mobile system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems. General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of cellular system.

UNIT-II	INTERFERENCE & CELL COVERAGE FOR SIGNAL AND TRAFFIC	Classes:15

Introduction to Co-channel interference, real time co-channel interference, Co-channelmeasurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types. Signal reflections in flat and hilly terrain, effect of human madestructures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation antenna height gain, form of a point to point model.

UNIT-III	CELL SITE AND MOBILE ANTENNAS & FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT	Classes:15

Sum and difference patterns and their synthesis, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas. Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

UNIT-IV	HANDOFF & DIGITAL CELLULAR NETWORKS	Classes:15

Handoff, dropped calls and cell splitting, types of handoff, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation. GSM architecture, GSM channels, multiplex access scheme, TDMA, CDMA.

Text Books

1. Mobile cellular telecommunications-W .C. Y. Lee, Tata Mc-Graw Hill, 2nd Edition, 2006.
2. Wireless communications-Theodore. S. Rapport, Pearson Education, 2ndEdn., 2002.

Reference Books

1. Principles of Mobile communications-Gordon L. Stuber, Springer International 2nd Edition, 2007.
2. Wireless and Mobile Communications-Lee Mc Graw Hills, 3rd Edition, 2006.

Web References

1. https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BEC603%20%20-CELLULAR%20 MOBILE%20 COMMUNICATION. pdf
2. http://www.swiftutors.com/cellular-systems.html

E-Text Books

1. Cellular & Mobile Communications-V.Jeyasri Arokiamary, Technical Publications, 1st Edition, 2011.

Outcomes

1. Understand the concept of cellular mobile radio systems.
2. Explain the elements of cellular radio system design.
3. Discuss the techniques of antenna system and their parameters.
4. Discuss the cell site, mobile antennas and frequency management scheme.
5. Explain the handoff techniques.
6. Understand the digital cellular networks

RADAR ENGINEERING (Elective – IV)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1801	Core	3	1	-	3	40	60	100
Contact Classes:51	Tutorial Classes: -9	Practical Classes: Nil			Total Classes:60			

OBJECTIVES

The course should enable the students to

I To learn Radar Fundamentals like Radar Equation, Operating frequencies & Applications.

II. To understand the basic concepts of different types of Radars for surveillance & Tracking.

III. To know the various types of tracking techniques involved.

IV. To understand Radar Receivers, MTI filters, displays and antennas.

UNIT-I	BASICS OF RADAR & RADAR EQUATION	Classes:15

Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, RadarBlock Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems. SNR, Envelope Detector, False Alarm Time and Probability, Integration of RadarPulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

UNIT-II	CW & FREQUENCY MODULATED RADAR	Classes:15

Doppler Effect, CW Radar – Block Diagram, Isolation betweenTransmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems.FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

UNIT-III	MTI AND PULSE DOPPLER RADAR & TRACKING RADAR	Classes:15

Introduction, Principle, MTI Radar with - Power Amplifier Transmitterand Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar. Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar –Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT-IV	DETECTION OF RADAR SIGNALS IN NOISE & RADAR RECEIVERS	Classes:15

Introduction, Matched Filter Receiver – ResponseCharacteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise. Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch typeand Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Series versus Parallel Feeds, Applications, Advantages and Limitations

Text Books

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Edition, 2007.

Reference Books

1. Introduction to Radar Systems – Merrill I. Skolnik, 3rd Edition, Tata McGraw-Hill, 2001.
2. Radar Principals, Technology, Applications – Byron Edde, Pearson Education, 2004.

Web References

1. https://www.tutorialspoint.com/radar_systems/index.htm
2. https://www.slideshare.net/karheng1/a-tutorial-on-radar-system-engineering

E-Text Books

1. Electronic Scanning Radar Systems- Peter J. Kahrilas, Artech print on Demand, 1976

Outcomes

1. Discuss the fundamental of RADAR
2. Compare different types of RADAR and their working
3. Explain MTI & pulse Doppler RADAR
4. Describe the working of tracking RADAR
5. Examine RADAR signal detection techniques
6. Differentiate types of RADAR receivers

ASIC DESIGN (Elective – IV)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1803	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil			Total Classes:60			

OBJECTIVES

The course should enable the students to

I. This course focuses exclusively on digital CMOS Application Specific Integrated Circuit (ASIC) systems design and automation.

II. The ASIC physical design flow, including logic synthesis, floor plan ning, placement, clock tree synthesis and routing will be presented.

UNIT-I	INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN	Classes:15

Types of ASICs - Design flow - CMOStransistors CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort –Library cell design - Library architecture.

UNIT-II	PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS	Classes:15

Anti fuse -static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT-III	PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY	Classes:15

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 6000 - Altera MAX 9000 - Altera FLEX–Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation.

UNIT-IV	LOGIC SYNTEHESIS, SIMULATION AND TESTING & ASIC CONSTRUCTION, FLOOR PLANNING AND ROUTING	Classes:15

Verilog and logic synthesis -VHDL and logic synthesis -types of simulation -boundary scan test - fault simulation - automatic test pattern generation. System partition - FPGA partitioning -partitioning methods - floor planning - placement - physical design flow –global routing - detailed routing - special routing - circuit extraction - DRC.

Text Books

1. Smith M.J.S ., “Application Specific Integrated Circuits, Addison - Wesley Longman Inc., 1997.
2. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.

Reference Books

1. Rajsuman R., System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.
2. Nekoogar F.. Timing Verification of Application-Specific Integrated Circuits (ASICs). Prentice Hall PTR, 1999

Web References

1. http://www.csit-sun.pub.ro/resources/asic/CH15.pdf
2. https://anysilicon.com/asic-design-flow-ultimate-guide/
3. https://www.slideshare.net/helloactiva/asic-design-40406910

E-Text Books

1. Application-Specific Integrated Circuits-Michael John Sebastian Smith, Pearson

Outcomes

1. Discuss need for programmable devices.
2. Describe architecture of programmable devices
3. Explain different 1Programmable methodologies
4. Understand the fundamentals of digital logic design and physical features of each ASIC.
5. Explain the types of synthesis and simulation and test pattern generation techniques
6. Understand the ASIC design, testing of physical design, partitioning, floor planning, placement and routing

NEURAL NETWORKS AND FUZZY LOGIC (Elective – III)

B.Tech 7th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EE1704	Core	3	1	-	3	40	60	100
Contact Classes:60	Tutorial Classes: 5	Practical Classes: Nil			Total Classes:65			

OBJECTIVES

I. This course introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks.

II. To deals with Associate Memories and introduces Fuzzy sets and Fuzzy Logic system components along with Genetic Algorithms.

III. The Application of Soft Computing Techniques to Electrical Engineering is also presented.

UNIT-I	ARTIFICIAL NEURAL NETWORKS AND ITS ES SENTIALS	Classes:20

Artificial Neural Networks and Its Essentials: Introduction, Biological Neuron, Artificial Neuron, Basic concepts of Neural Networks, Basic Models of ANN Connections, McCulloch-Pitts Model, Characteristics of ANN, Applications of ANN. Artificial Neuron Model. Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT-II	LEARNING AND ASSOCIATIVE MEMORY NETWORKS	Classes:15

Learning and Associative Memory Networks: Perceptron Network, Perceptron Learning Rule, Architecture, Perceptron Training Algorithm, ADALINE, MADALINE, Back Propagation Network, BP Learning Rule, Input Layer Computation, Hidden Layer Computation, Output Layer Computation, Radial Basis Function, Associative Memory, Bidirectional associative memory.

UNIT-III	FUZZY LOGIC	Classes:15

Fuzzy Logic: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT-IV	GENETIC ALGORITHMS AND AI APPLICATIONS TO ELECTRICAL SYSTEMS	Classes:15

Genetic Algorithms and AI Applications to Electrical Systems: Introduction, Basic Operators and Terminologies in GA, Traditional Vs Genetic Algorithm, Encoding, Fitness Function, Reproduction, Crossover, Mutation Operator.

ANN based Short term Load Forecasting, Load flow Studies, Fuzzy logic based Unit Commitment and Genetic Algorithm based Economic Dispatch.

Text Books

1. S. N. Sivanandam and S. N. Deepa "Principles of – Soft Computing", Wiley India Edition.2011
2. Rajasekharan and Pai "Neural Networks, "Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publications. 2003

Reference Books

1. Satish Kumar "Neural networks", TMH, 2004.
2. Timothy J. Ross "Fuzzy Logic with Engineering Applications", Third Edition. 2010 John Wiley & Sons, Ltd.
3. J. S. R. Jang, C. T. Sun and E. Mizutani "Neuro Fuzzy and Soft Computing", Pearson Education.

Web References

1. https://www.researchgate.net
2 https://www.facstaff.bucknell.edu/
3. https://www.electrical4u.com
4. https://www.audisankara.ac.in

E-Text Books

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

Outcomes

CO1: Demonstrate knowledge in Neural networks

CO2: Understand the concepts of fuzzy logic controllers

CO3: Demonstrate knowledge in Design of fuzzy controllers

CO4: Design Adaptive fuzzy controllers

CO5: Apply fuzzy logic and neural networks for real time systems

CO6: Gain knowledge about basic operators in Genetic Algorithm and its implementation

SATELLITE COMMUNICATIONS (Elective – V)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1805	Core	3	1	-	3	40	60	100
Contact Classes:5	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To enable the student to become familiar with satellites and satellite services.

II. Study of satellite orbits and launching

III. Study of earth segment and space segment components

IV. Study of satellite access by various users.

UNIT-I	INTRODUCTION & ORBITAL MECHANICS AND LAUNCHERS	Classes:15

Origin of satellite communications, Historical background, basic concepts of satellitecommunications, frequency allocations for satellite services, applications, future trends of satellite communications. Orbital Mechanics look angle determination, orbitalperturbations, orbit determination, launches and launch vehicles, orbital effects in communication systems performance.

UNIT-II	SATELLITE SUBSYSTEMS & SATELLITE LINK DESIGN	Classes:15

Attitude and orbital control system, Telemetry, Tracking, command andmonitoring, power systems, communication subsystems, satellite antenna equipment reliability and space qualification.Basic transmission theory, system noise temperature and G/T ratio, design ofdown links, uplink design, design of satellite links for specified C/N, system design example.

UNIT-III	MULTIPLE ACCESS & EARTH STATION TECHNOLOGY	Classes:15

Frequency division multiple access (FDMA) Intermodulation, calculation of C/N,Time Division multiple access (TDMA) frame structure, examples. Satellite switched TDMA onboard processing, DAMA, code division multiple access (CDMA), spread spectrum transmission and Reception. Introduction, transmitters, receivers, Antennas, tracking systems, terrestrial interface, primary power test methods.

UNIT-IV	LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS & SATELLITE NAVIGTION AND THE GLOBAL POSITIONING SYSTEM	Classes:15

Orbit consideration, coverage and frequency considerations, delay and throughput considerations, system considerations, operational NGSO constellation designs. Radio and satellite navigation, GPS positionlocation principles, GPS receivers and codes, satellite signal acquisition, GPS navigation message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, differential GPS.

Text Books

1. Satellite Communications-Timothi Pratt, Charles Bostian And Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. Satellite Communications Engineering-Wilbur L.Prichard, Robert A. Nelson & Henry G.Suyderhoud, 2nd Edition, Pearson Publications, 2003.

Reference Books

1. Satellite communications: Design principles-M. Richharia, BS publications, 2nd Edition, 2003.
2. Satellite communications-D.C.Agarwal, Khanna publications, 5th Ed.

Web References

1. https://www.tutorialspoint.com/principles_of_communication/principles_of_satellite_communications.htm
2. https://www.isro.gov.in/applications/satellite-communication
3. https://www.britannica.com/technology/satellite-communication/Development-of-satellite-communication

E-Text Books

1. Satellite Communications-Timothy Pratt, Charles Bastian, Jeremy Allnutt, Wiley Publications, 2nd edition.
2. Satellite Communications- Sapna Katiyar, S.K.Kataria & Sons, 2013 edition.

Outcomes

1. Understand the basic concepts in the field of satellite communication.
2. Explain the basic concepts of satellite link design.
3. Understand the basic concepts of satellite subsystems.
4. Differentiate multiple access techniques used in satellite communication system.
5. Describe Geo-Stationary Satellite Systems
6. Analyze the GPS receivers.

DIGITAL DESIGN THROUGH HDL (Elective – V)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1806	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. The ability to code and simulate any digital function in Verilog HDL. Know the difference between synthesizable and non-synthesizable code.

II. Understand library modeling, behavioral code and the differences between them.

III. Understand the differences between simulator algorithms.

IV. Learn good coding techniques per current industrial practices.

V. Understand logic verification using Verilog simulation.

UNIT-I	INTRODUCTION TO VERILOG HDL	Classes:15

Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming LanguageInterface, Module, Simulation and Synthesis Tools Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.

UNIT-II	GATE LEVEL MODELING & MODELING AT DATAFLOW LEVEL	Classes:15

Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Design of Basic Circuit. Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.

UNIT-III	BEHAVIOURAL MODELING, SWITCH LEVEL MODELING & SYSTEM TASKS, FUNCTIONS AND COMPILER DIRECTIVES	Classes:15

Introduction, Operations and Assignments,Functional Bifuracation, 'Intial' Construct, Assignments with Delays, 'Wait'Construct, MultipleAlwaysBlock, Designsat Behavioural Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, Parallel Blocks, Force-Release, Construct, Event. BasicTransistor Switches, CMOS Switches, BiDirectional Gates, Time Delays with Switch Primitives, Instantiation with 'Strenths' and 'Delays' Strength Contention with Trireg Nets. Parameters, Path Delays, Module Parameters. SystemTasks and Functions,File Based Tasks and Functions, Computer Directives, Hierarchical Access,User Defined Prinitives.

UNIT-IV	SEQUENTIAL CIRCUIT DESCRIPTION & COMPONENTS TEST AND VERIFICATION	Classes:15

Sequential Models - Feedback Model, Capacitive Model, Implicit Model, Basic Memory Components, Functional Register, Static Machine Coding, Sequential Synthesis. Test Bench - Combinational Circuits Testing, Sequential Circuit Testing, Test Bench Techiniques,Desin Verification, Assetion Verification.

Text Books

1. T.R. Padmanabhan, B. Bala Tripura Sundari , Design through Verilog HDL –, Wiley, 2009.
2. Zainalabdien Navabi, Verilog Digital System Design, TMH, 2nd Edition.

Reference Books

1. Fundamentals of Logic Design with Verilog Design– Stephen. Brown and Zvonko Vranesic, TMH, 2nd Edition 2010.
2. Advanced Digital Logic Design using Verilog, State Machine & Synthesis for FPGA – Sunggu Lee, Cengage Learning , 2012.

Web References

1. https://epdf.tips/design-through-verilog-hdl.html
2. https://www.mepits.com/tutorial/143/vlsi/hardware-description-language
3. https://www.iare.ac.in/sites/default/files/PPT/DDTV_PPT_0.pdf

E-Text Books

1. Digital Design HDL-Based Approach- Manjita Srivastava, Atul K. Srivastava, Mahesh C. Srivastava, Cengage Learning, 1st Edition, 2011.
2. Digital Design: with an Introduction to the Verilog Hdl-M.Morris Mano, Pearson, 5th edition, 2014.

Outcomes

1. Describe Verilog hardware description language
2. Design digital circuits in Verilog HDL
3. Write behavioral models and RTL models of digital circuits
4. Describe standard cell libraries and FPGAs
5. Synthesize RTL models to standard cell libraries and FPGAs
6. Implement RTL models on FPGAs and Testing & verification

MICRO ELECTRO MECHANICAL SYSTEMS (Elective – V)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1807	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil			Total Classes:60			

OBJECTIVES

The course should enable the students to

I. Introduction to MEMS and micro fabrication

II. To study the essential material properties

III. To study various sensing and transduction technique

IV. To know various fabrication and machining process of MEMS

V. To know about the polymer and optical MEMS.

UNIT-I	INTRODUCTION	Classes:15

History of Micro-Electro Mechanical Systems (MEMS), market for MEMS, Introductionand origin of MEMS, driving force for MEMS development, fabrication process, MEMS fabrication technologies: Conventional IC fabrication processes, bulk micro machining, surface micro machining, LIGA process, anodic and fusion bonding, packaging techniques for MEMS.

UNIT-II	MEMS SENSOR AND ACTUATORS	Classes:15

Sensors, Classification and terminology of sensors, evolution ofsemiconductor sensors, sensor Characterization basic concept of acoustic, mechanical, magnetic, radiation, thermal sensors and integrated sensors. Actuation in MEMS devices, electrostatic actuation, parallel plate capacitor-cantilever beam based movement, comb-drive structures.

UNIT-III	RF MEMS	Classes:15

Introduction to RF MEMS technologies: Need for RF MEMS components incommunications, space and defense applications, Materials and fabrication technologies, Actuation methods in MEMS, Special considerations in RF MEMS design. MEM switch; Cantilever based MEM switch, Membrane based switch design microwave material and mechanical considerations.

UNIT-IV	MEMS APPLICATIONS & NEMS	Classes:15

Examples of RF MEMS components and case studies: Micro-switches, Planar,on-chip components, Transmission lines and other components, Micro machined and reconfigurableantennas, Micro machined phase shifters. Introduction to Nanotechnology.

Text Books

1. N Maluf , "An Introduction to Microelectromechanical Systems Engineering", 2nd ed., Artech House,2004.
2. M. Madou, "Fundamentals of Micro Fabrication", 2nd ed., CRC Press,2002.

Reference Books

1. J.W. Gardner , V.K. Varadan , O.O. Awadelkarim, "Microsensors, MEMS & SmartDevices", John Wiley, 2001.
2. H.J. De Los Santos, "Introduction to Microelectromechanical (MEM) Microwave Systems", Artech house, 1999.

Web References

1. https://www.sciencedirect.com/topics/engineering/micro-electro-mechanical-system
2. http://www.sensorland.com/HowPage023.html

E-Text Books

1. Micro Electro Mechanical System Design-James J. Allen, CRC Press, 1st Edition, 2005.
2. MEMS: Fundamental Technology and Applications-Vikas Choudhary, Krzysztof Iniewski,CRC Press, 1st edition, 2017

Outcomes

1. Explain important concepts of MEMS
2. Classify and Demonstrate various MEMS sensors and actuators
3. Design RF MEMS components in various applications
4. Discuss operation of RF MEMS components
5. Design various MEMS switches
6. Examine MEMS fabrication process and packing techniques

AVAILABLE SELECTED MOOCs (ELECTIVE-V)

B.Tech 8th Semester: : Electronics & Communiations Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
16EC1808	Core	L	T	P	C	CIA	SEE	TOTAL
		3	1	-	3	40	60	100
Contact Classes: -	Tutorial Classes: -	Practical Classes: Nil				Total Classes: -		

Meeting with the global requirements, to inculcate the habit of self learning and incompliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion for the course from the MOOCs providers

Regulations for MOOCs

- The respective departments shall give a list from NPTEL or any other standard providers, whose credentials are endorsed by the HOD.
- Each department shall appoint Coordinators/Mentors and allot the students to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same.
- A student shall choose an online course (relevant to his/her programme of study) from the given list of MOOCs providers, as endorsed by the teacher concerned, with the approval of the HOD.
- The details of MOOC(s) shall be displayed in Grade card of a student, provided he/she submits the proof of completion of it to the department concerned through the Coordinator/Mentor.
- Student can get certificate from SWAYAM/NPTEL or any other standard providers, whose credentials are endorsed by the HOD. The course work should not be less than 12 weeks or student may appear for end examination conducted by the Institute.

- There shall be one Mid Continuous Internal Examination (Quiz exam for 40 marks) after 9 weeks of the commencement of the course and semester end examination (Descriptive exam for 60 marks) shall be done along with the other regular courses.

Three credits will be awarded upon successful completion of each MOOC courses having minimum of 8 weeks duration.

DATA COMMUNICATIONS (Elective – VI)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1809	Core	3	1	-	3	40	60	100
Contact Classes:51	Tutorial Classes: -9	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. Be aware of the history of communications, information systems, and the Internet

II. Be aware of the applications of data communication networks

III. Be familiar with the major components of and types of networks

IV. Understand the role of network layers

V. Be familiar with the role of network standards

VI. Be aware of three key trends in communications and networking

UNIT-I	INTRODUCTION TO DATA COMMUNICATION AND NETWORKING, SIGNALS, NOISE, MODULATION AND DEMODULATION, METALLIC CABLE TRANSMISSION MEDIA & OPTICAL FIBER TRANSMISSION MEDIA	Classes:15

Standards Organizations for DataCommunications, Layered Network Architecture, Open Systems Interconnection, Data Communications Circuits, Serial and parallel Data Transmission, Data communications Circuit Arrangements. Signal Analysis, Electrical Noise and Signal-to-NoiseRatio, Analog Modulation Systems, Information Capacity, Bits, Bit Rate, Baud, and *M*-ary Encoding, Digital Modulation. Metallic Transmission Lines, Transverse Electromagnetic Waves,Characteristics of Electromagnetic Waves, Transmission Line Classifications, Metallic Transmission Line Types, Metallic Transmission Line Equivalent Circuit, Wave Propagation on Metallic

Transmission Lines, Metallic Transmission Line Losses.Advantages of Optical Fiber Cables, Disadvantages of OpticalFiber Cables, Electromagnetic spectrum, Optical Fiber Communications System Block Diagram, Optical Fiber construction, The Physics of Light, Velocity of Propagation, Propagation of Light Through an Optical fiber Cable, Optical Fiber Modes and Classifications, Optical Fiber Comparison, Losses in Optical Fiber Cables, Light sources, Light Detectors, Lasers.

UNIT-II	**DIGITAL TRANSMISSION, MULTIPLEXING AND T CARRIERS & WIRELESS COMMUNICATIONS SYSTEMS**	**Classes:15**

Pulse Modulation, Pulse code Modulation, Dynamic Range, Signal Voltage –to-Quantization Noise Voltage Ration, Linear Versus Nonlinear PCM Codes, Companding, PCM Line Speed, Delta Modulation PCM and Differential PCM. Time- Division Multiplexing, T1 Digital Carrier System, North AmericanDigital Multiplexing Hierarchy, Digital Line Encoding, T Carrier systems, European Time- Division Multiplexing, Statistical Time – Division Multiplexing, Frame Synchronization, Frequency- Division Multiplexing, Wavelength- Division Multiplexing, Synchronous Optical Network. Electromagnetic Polarization, Rays and Wavefronts,Electromagnetic Radiation, Spherical Wavefront and the Inverse Square Law, wave Attenuation and Absorption, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves, Skip Distance, Free-Space Path Loss, Microwave Communications Systems, Satellite Communications Systems.

UNIT-III	**TELEPHONE INSTRUMENTS AND SIGNALS, THE TELEPHONE CIRCUIT & CELLULAR TELEPHONE SYSTEMS**	**Classes:15**

The Subscriber Loop, Standard Telephone Set, Basic TelephoneCall Procedures, Call Progress Tones and Signals, Cordless Telephones, Caller ID, Electronic Telephones, Paging systems. The Local Subscriber Loop, Telephone Message- Channel Noise and NoiseWeighting, Units of Powers Measurement, Transmission Parameters and Private-Line Circuits, Voice-Frequency Circuit Arrangements, Crosstalk.Concepts – Frequency reuse-Cell splitting – Network components –Call Processing - First- Generation Analog Cellular Telephone, Personal Communications system, Second-Generation Cellular Telephone Systems, N-AMPS, Digital Cellular Telephone, Global system for Mobile Communications.

UNIT-IV	DATA COMMUNICATIONS CODE, ERROR CONTROL, AND DATA FORMATS, DATA COMMUNICATIONS EQUIPMENT & DATA-LINK PROTOCOLS	Classes:15

Data Communications CharacterCodes, Bar Codes, Error Control, Error Detection, Error Correction, Character Synchronization. Digital Service Unit and Channel Service Unit, Voice- Band DataCommunication Modems, Bell Systems- Compatible Voice- Band Modems, Voice- Band Modern Block Diagram, Voice- Band Modem Classifications, Asynchronous Voice-Band Modems, Synchronous Voice-Band Modems, Modem Synchronization, ITU-T Voice- Band Modem Specifications, 56K Modems, Modem Control: The AT Command Set, Cable Modems, Probability of Error and Bit Error Rate. Data –Link Protocol functions, Character –and Bit- Oriented Protocols, DataTransmission Modes, Asynchronous Data – Link Protocols, Synchronous Data – Link Protocols, Synchronous Data – Link Control, High – Level Data – Link Control.

Text Books

1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education.
2. Simon Haykin, "Communication Systems", Wiley-India Edition, 3rd Edition, 2010.

Reference Books

1. Data Communications and Networking, Behrouz A Forouzan, 4th Edition, TMH.
2. Computer Communications and Networking Technologies, Gallow, 2nd edition, Thomson.

Web References

1. https://www.tutorialspoint.com/data_ communication_ computer_network/
2. http://ecomputernotes.com/computernetworkingnotes/communication networks/what-is-data-communication
3. https://what-when-how.com/data-communications-and-networking/ data communications - networks/

E-Text Books

1. Data Communications and Networking-Behrouz A Forouzan, Mcgraw Hill, 4th edition.

Outcomes

1. Describe the basic OSI reference model.
2. Describe the metallic cable and fiber cable transmission process.
3. Explain the digital transmission with multiplexing.
4. Discuss about wireless communication system and protocols.
5. Explain about cellular and telephone systems.
6. Use error detection and correction methods.

RFID TECHNOLOGY (Elective – VI)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1810	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: - 10		Practical Classes: Nil			Total Classes:60		

OBJECTIVES

The course should enable the students to

I. Consider the main research techniques that have been used to evaluate the impact of security technologies.

II. Identify the main drivers that have led to the growth of technological fixes to modern security risks.

III. Examine how the technologies are impacting or could potentially impact on offending behaviour and their effect on society.

IV. Review research findings related to the effectiveness of the technologies.

UNIT-I	UNDERSTANDING RFID TECHNOLOGY & HISTORY OF THE EPC	Classes:15

Introduction, RFID Technology, The Elements of an RFID system,Coupling, Range, and Penetration, RFID Applications, VeriChip and Mark of the Beast.Introduction, The Distributed Intelligent Systems Center, Meanwhile, at ProcterGamble, “Low-Cost” RFID Protocols, “Low-cost” Manufacturing, The Software and the Network, Privacy, Harnessing the Juggernaut, The Six Auto-ID Labs, The Evolution of the Industry, The Creation of EPC global.

UNIT-II	RFID AND GLOBAL PRIVACY POLICY	Classes:15

Introduction, Definitions of Privacy, Definitions of PersonalInformation, History of Current Privacy Paradigm, Mapping the RFID Discovery process, Functions and Responsibilities for chips, Readers, and Owners, Privacy as a Fundamental Human Right, Constitutional Rights.

UNIT-III	RFID, PRIVACY AND REGULATION	Classes:15

Introduction, Understanding RFID's Privacy Threats. RFID and theUnited States Regulatory Landscape: Introduction, Current State of RFID Policy, Individuals, Business, Government, Miscellaneous, Integrity and Security of the System, Government Access, Health Impact, Labor Impact

UNIT-IV	APPLICATIONS	Classes:15

RFID Payments at ExxonMobil, Exxon Mobil Corporation, Transforming the Battlefieldwith RFID, Logistics and the Military, RFID in the Pharmacy, CVS and Auto-ID, Project Jump Start, RFID in the Store.

Text Books

1. Simson Garfinkel and Beth Rosenberg, "RFID Applications, Security, and privacy", Pearson Education, 2005.
2. Steven Shepard, "Radio Frequency Identification", First edition, McGraw-Hill Professional, 2004.

Reference Books

1. John R. Williams, Stephen B. Miles, Sanjay E. Sarma, "RFID Technology and Applications", Cambridge University Press, 2008.

Web References

1. https://www.epc-rfid.info/rfid
2. https://www.it.iitb.ac.in/~sri/talks/rfid-05.pdf

E-Text Books

1. RFID Design Fundamentals and Applications-Albert Lozano-Nieto, Taylor & Francis Inc.

Outcomes

1. Describe for evolution of RFID technology
2. Explain the basic principle of RFID technology
3. Understand Low-cost RFID issues.
4. Discuss privacy issues regarding RFID technology globally
5. Discuss regulations for RFID technology to use globally.
6. Discuss different application areas of RFID technology

VIRTUAL INSTRUMENTATION (Elective – VI)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
16EC1811	Core	L	T	P	C	CIA	SEE	TOTAL
		3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

OBJECTIVES

The course should enable the students to

I. To provide knowledge on design of process control by using virtual instrumentation techniques.

II. To provide knowledge in process analysis by VI tools.

III. To give basic knowledge in describing function analysis.

IV. Get adequate knowledge VI tool sets

UNIT-I	REVIEW OF VIRTUAL INSTRUMENTATION & PROGRAMMING TECHNIQUES	Classes:15

Historical perspective, Need of VI, Advantages of VI, Define VI, block diagram & architecture of VI, data flow techniques, graphical programming in data flow, comparison with conventional programming. VIS and sub-VIS, loops & charts, arrays, clusters, graphs, case & sequence structures, formula modes, local and global variable, string & file input. Graphical programming in data flow, comparison with conventional programming.

UNIT-II	DATA ACQUISITION BASICS	Classes:15

ADC, DAC, DIO, Counters & timers, PC Hardware structure, timing, interrupts, DMA, Software and Hardware Installation. GPIB/IEEE 488 concepts, and embedded system buses - PCI, EISA, CPCI, and USB & VXI. A

UNIT-III	COMMON INSTRUMENT INTERFACES	Classes:15

Current loop, RS 232C/RS 485, GPIB, System basics, interface basics: USB, PCMCIA, VXI, SCXI, PXI etc, networking basics for office & industrial application VISA & IVI, image acquisition & processing, Motion Control. ADC, DAC, DIO, DMM, wave form generator.

UNIT-IV	USE OF ANALYSIS TOOLS AND APPLICATIONS OF VI	Classes:15

Fourier transforms Power spectrum, Correlation methods, windowing & flittering. Application in Process Control projects, Major equipments- Oscilloscope, Digital Multimeter, Pentium Computers, temperature data acquisition system, motion control employing stepper motor.

Text Books

1. Gary Johnson, LABVIEW Graphical Programming, 2nd Edition, McGraw Hill, 1997.
2. Lisa K. Wells and Jeffrey Travis, LABVIEW for Everyone, PHI, 1997.

Reference Books

1. S. Gupta, J.P. Gupta, PC Interfacing for Data Acquisition and Process Control, ISA, 2nd Edition, 1994.
2. Technical Manuals for DAS Modules of Advantech and National In struments.

Web References

1. http://www.ni.com/en-in/innovations/white-papers/06/virtual-instrumentation.html
2. https://www.slideshare.net/PrincyRandhawa/virtual-instrumentation-labview
3. https://www.globalspec.com/reference/67234/203279/chapter-1-introduction-to-virtual-instrumentation

E-Text Books

1. Virtual Instrumentation Using Labview-Jerome J, Prentice Hall India Learning Private Limited, 2010

Outcomes

1. Describe basic concepts of instrumentation.
2. Describe basic concepts of data acquisition.
3. Explain V-I tool sets.
4. Explain common instruments for interfacing with VI.
5. Discuss V-I programming technique.
6. Apply the basic concepts of Analysis tools and applications of VI.

AVAILABLE SELECTED MOOCs (Elective – VI)

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC1812	Core	3	1	-	3	40	60	100
Contact Classes:50	Tutorial Classes: -10	Practical Classes: Nil				Total Classes:60		

Meeting with the global requirements, to inculcate the habit of self learning and incompliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives. The main intension to introduce MOOCs is to obtain enough exposure through online tutorials, self-learning at one's own pace, attempt quizzes, discuss with professors from various universities and finally to obtain certificate of completion for the course from the MOOCs providers

Regulations for MOOCs

- The respective departments shall give a list from NPTEL or any other standard providers, whose credentials are endorsed by the HOD.
- Each department shall appoint Coordinators/Mentors and allot the students to them who shall be responsible to guide students in selecting online courses and provide guidance for the registration, progress and completion of the same.
- A student shall choose an online course (relevant to his/her programme of study) from the given list of MOOCs providers, as endorsed by the teacher concerned, with the approval of the HOD.
- The details of MOOC(s) shall be displayed in Grade card of a student, provided he/she submits the proof of completion of it to the department concerned through the Coordinator/Mentor.
- Student can get certificate from SWAYAM/NPTEL or any other standard providers, whose credentials are endorsed by the HOD. The course work should not be less than 12 weeks or student may appear for end examination conducted by the Institute.
- There shall be one Mid Continuous Internal Examination (Quiz exam for 40 marks) after 9 weeks of the commencement of the course and semester end examination (Descriptive exam for 60 marks) shall be done along with the other regular courses.
- Three credits will be awarded upon successful completion of each MOOC courses having minimum of 8 weeks duration.

MAJOR PROJECT AND COMPREHENSIVE VIVA – VOCE

B.Tech 8th Semester: Electronics & Communication Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
16EC2814	Core	-	-	8	12	60	140	200
Contact Classes: -	Tutorial Classes: -	Practical Classes: 75				Total Classes: 75		

Internal Evaluation for Major Project Work

The major project shall be carried out during the 8th Semester in the **Non FSI Model** and shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for semester end evaluation. Major project will be taken up batch wise and batches will be divided as per the guidelines. The object of major project is to enable the student to extend further the investigative study taken up as the project in Mini project under the guidance of the supervisor/ guide from the department.

The assignment normally includes:

- Preparing an action plan for conducting the investigation including the team work.
- In depth study of the topic assigned.
- Review and finalization of the approach to the problem relating to the assigned topic.
- Final development of product/process, testing, results, conclusions and further direction.
- Preparing a paper for conference presentation/ publication in journal if possible.
- Preparing a dissertation in the standard format for being evaluated by the department.
- Final presentation of the work done before the Project Review Committee (PRC).

Major Project is allocated 60 internal marks. Out of 60, 30 marks are allocated for the supervisor/guide and head of the department to be evaluated based on two seminars given by each student on the topic of the

project. The other 30 marks shall be evaluated on the basis of his presentation on the work done on his project by the Departmental Committee comprising of Head of the Department, respective supervisor/ guide and two senior faculty of the department appointed by the Principal.

External Evaluation for Major Project

The major project shall be carried out during the 8th Semester in the **Non FSI Model** and shall be evaluated for 200 marks. The Semester End Examination for major project work done during 8th Semester and for 140 marks shall be conducted by a Project Review Committee (PRC). The committee comprises of an External Examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor. The evaluation of project work shall be conducted at the end of the 8th Semester. The above committee evaluates the project work report with weightages of 50% of the marks (50 marks) awarded by external examiner, 20% of marks (20 marks) awarded by HOD & 30% of the marks (30 marks) by Project Guide/Supervisor respectively for a total of 100 marks. Of the 40 marks for Presentation & Viva-Voce examination, HOD evaluates for 10 marks and external examiner for 30 marks. The evaluation of 140 marks is distributed as given below:

Sl. No.	Criterion	Marks
1	Report	100
2	Presentation & Viva – Voce	40

A candidate shall be declared to have passed in major project if he secures a minimum of 50% aggregate marks (100 marks) (Internal & Semester External Examination marks put together), subject to a minimum of 50% marks (70 marks) in the major project end examination.