ACADEMIC REGULATIONS
COURSE STRUCTURE
and
DETAILED SYLLABUS

ELECTRONICS & COMMUNICATION ENGINEERING

For

B.Tech. FOUR YEAR U.G. COURSE
(Applicable for batches admitted from 2020-2021)

☎:08818-284577, 284355 Ext: 321; Fax: 08818-284577 Visit us at: www.srivasaviengg.ac.in

SRI VASAVI ENGINEERING COLLEGE (Autonomous)

(Sponsored by Sri Vasavi Educational Society)
(Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada)
(Accredited by NAAC with 'A' Grade ,Recognized by UGC under section 2(f) & 12(B))
Pedatadepalli, **TADEPALLIGUDEM – 534 101.**W.G.Dist**. (A.P)**

Institute Vision and Mission

Vision

- To be a premier technological institute striving for excellence with global perspective and commitment to the nation

Mission

- To produce Engineering graduates of professional quality and global perspective through learner-centric education.
- To establish linkages with government, industry and Research laboratories to promote Rσ&D activities and to disseminate innovations.
- To create an eco-system in the institute that leads to holistic development and ability for life-long learning.

Department Vision and Mission

Vision:

- To develop the department into a center of excellence and produce high quality, technically competent and responsible Electronics and Communication Engineers.

Mission:

- To create a learner centric environment that promotes the intellectual growth of the students.
- To develop linkages with R & D organizations and educational institutions for excellence in teaching, learning and consultancy practices.
- To build the student community with high ethical standards.

Program Educational Objectives (PEOs)

Graduates of this programme will:

PEO 1: Have successful career in the field of Electronics & Communication Engineering.

PEO 2: Design products for societal needs.

PEO 3: Demonstrate their abilities to support service activities with due consideration for ethics and human values.

Programme Specific Outcomes (PSO s):

A graduate of the Electronics and Communication Engineering Program will be able to:

PSO 1: use modern tools to design subsystems for simple applications in Embedded Systems and VLSI. [K3]

PSO 2: apply engineering concepts to find solutions in the fields of Communications, Signal/ Image Processing. [K3]

Program Outcomes (POs):

Electronics & Communication Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and concepts of Electronics & Communication engineering to solve the complex engineering problems.[K3]

2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using mathematics, natural sciences, and electronics and communication engineering principles. [K4]

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.[K5]

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. [K5]

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and Electronics Design Automation tools including prediction and modeling to complex engineering activities with an understanding of the limitations. [K3]

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice. [K3]

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development. [K3]

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. [K3]

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. [K6]

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. [K2]

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. [K6]

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.[K1]

ACADEMIC RULES
AND
REGULATIONS

AUTONOMOUS COLLEGES OF JNTUK
COMMON ACADEMIC REGULATIONS (R20) FOR B. TECH PROGRAMME
(Applicable for from the Academic Year 2020-21)

1. Award of B. Tech. Degree

(a) A student will be declared eligible for the award of B. Tech. Degree if he fulfils the following academic regulations:
   (i) A student shall be declared eligible for the award of B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.
   (ii) The candidate shall register for 160 credits and secure all the 160 credits.

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

2. Programme Pattern:

a) Total duration of the of B. Tech (Regular) Programme is four academic years
b) Each Academic year of study is divided into **Two Semesters**.
c) Minimum number of instruction days in each semester is 90.
d) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
e) The total credits for the Programme is 160.
f) Three week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.
g) Student is introduced to "Choice Based Credit System (CBCS)".
h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)
i) A student has to register for all courses in a semester.
j) All the registered credits will be considered for the calculation of final CGPA.
k) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.
l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.
m) All the students shall be mandatorily registered for NCC, NSS activities and Community Service Project as per the Government and University norms.
n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

3. Registration for Courses:

a) In each semester a student shall mandatorily register courses which he/she wishes to pursue within a week from the starting of the class work with the advice of Head of the Department and mentor of the student of the concerned department of the college.
b) If any student wishes to withdraw the registration of the course, he/she shall submit a letter to the Principal of the college through the Head of the Department and mentor within fifteen days.

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

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

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

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

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

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

v. Credits are defined as per AICTE norms.

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

5. Attendance Requirements

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

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

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

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

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

f) A stipulated fee of Rs. 500/- in the concerned semester shall be payable towards condonation of shortage of attendance. Students availing condonation on medical ground shall produce a medical certificate issued by the competitive authority.

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

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

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

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

6. Evaluation-Distribution and Weightage of marks

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

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

(iii) For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the student has to secure 40% of the

marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

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

(v) Distribution and Weightage of marks:

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

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

(vi) Continuous Internal Theory Evaluation:

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

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

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

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

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

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

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

Example:

Mid-1 marks = Marks secured in (online examination-1+descriptive examination-1 +one assignment-1)

Mid-2 marks = Marks secured in (online examination-2+descriptive examination-2 +one assignment-2)

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

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

(vii) Semester End Theory Examinations Evaluation:

a) The semester end examinations will be conducted university examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
b) For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows: day to day work - 5 marks, Record-5 marks and the remaining 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner appointed.
c) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester for 15 marks each and final marks can be calculated with 80% weightage for better of the two tests and 20% weightage for other test and these are to be added to the marks obtained in day to day work.
d) Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. Students shall pursue this course during summer vacation just before its offering as per course structure. The minimum duration of this course is at least 6 weeks. The student shall register for the course as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the University. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner; Head of the Department; supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages respectively. It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.
e) The job oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the on the list skills learned. If the student completes job oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external and internal examiner (course instructor or mentor). There are no internal marks for the job oriented skill courses.
f) Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.
g) **Procedure for Conduct and Evaluation of MOOC:** There shall be a Discipline Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online with the approval of Head of the Department. The Head of the Department shall appoint

one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be pass.

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

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

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

7. Results Declaration:

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

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

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

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

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

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

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

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

12. Promotion Rules

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.5 for promotion to higher classes

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

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

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

13. Course Pattern

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

b) A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.
c) When a student is detained for lack of credits / shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

14. Earning of Credit:

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

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

15. Award of Class

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

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

16. Minimum Instruction Days

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

17. Withholding of Results

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

18. Transitory Regulations

a) Discontinued or detained candidates are eligible for re-admission as and when next offered.
b) The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.
c) (i) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.
d) The students seeking transfer to colleges affiliated to JNTUK from various other Universities / Institutions have to obtain the credits of any equivalent subjects as prescribed by JNTUK. In addition, the transferred candidates have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by JNTUK.

19. Gap - Year

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

20. General

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

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

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

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

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ACADEMIC REGULATIONS (R19) FOR B. TECH. (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2020-21 onwards

1 **Award of B. Tech. Degree**

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

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

b) The candidate shall register for 121 credits and secure all the 121 credits.

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

3. **Promotion Rules**

A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

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

4. **Award of Class**

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

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

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

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

COMMUNITY SERVICE PROJECT

Introduction

1. Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
2. Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
3. Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

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

1. To sensitize the students to the living conditions of the people who are around them,
2. To help students to realize the stark realities of the society.
3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
6. To help students to initiate developmental activities in the community in coordination with public and government authorities.
7. To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

1. Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation.
2. Each class/section should be assigned with a mentor.
3. Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
4. A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
5. The log book has to be countersigned by the concerned mentor/faculty in charge.
6. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
7. The final evaluation to be reflected in the grade memo of the student.
8. The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
9. Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
10. Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

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

2. The Community Service Project is a twofold one –

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

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

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

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

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

Personal Outcomes

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

Social Outcomes

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

Career Development

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

Relationship with the Institution

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

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

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

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

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

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

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

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

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

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

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

Programmes for School Children

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

Programmes for Women Empowerment

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

General Camps

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

Programmes for Youth Empowerment

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

Common Programmes

1. Awareness on RTI
2. Health intervention programmes
3. Yoga

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

Role of Students:

1. Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
2. For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
3. As and when required the College faculty themselves act as Resource Persons.
4. Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
5. And also, with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
6. An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. **Preliminary Survey (One Week)**
    a) A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
    b) A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
    c) The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.
2. ***Community Awareness Campaigns (Two Weeks)***
    Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.
3. ***Community Immersion Programme (Four Weeks)***
    Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.
4. ***Community Exit Report (One Week)***

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

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

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty	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.

	amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action and impose suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show because notice shall be issued to the college.
   - (ii) Impose a suitable fine on the college.
   - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

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

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
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Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

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LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

COURSE STRUCTURE
&
Syllabus

B. Tech ECE & ECT (V20 Regulation)

III Semester

Sl. No.	Course Code	Course Category & Course Title		L	T	P	Credits
1.	V20MAT03	BSC	Mathematics-III(M-III)	3	0	0	3
2.	V20ECT02	PCC	Electronic Devices, Circuits & Analysis (EDCA)	3	0	0	3
3.	V20MAT06	PCC	Probability Theory Stochastic Process (PTSP)	3	0	0	3
4.	V20ECT04	PCC	Network Theory(NT)	3	0	0	3
5.	V20ECT05	PCC	Signals & Systems(SS)	3	0	0	3
6.	V20ECL01	PCC	Electronic Devices, Circuits& Analysis Lab (EDCA LAB)	0	0	3	1.5
7.	V20ECL02	PCC	Signals & Systems Lab(SSLAB)	0	0	3	1.5
8.	V20CSL31	PCC	Data Structures Lab(DSLAB)	0	0	3	1.5
9.	V20COSP01	CSP	Community Service Project	0	0	8	4
10.	V20ECSOC01	SOC	Skill Oriented Course	1	0	2	2
11.	V20ENT02	Mandatory Course	Professional Communication Skills (PCS-I)	2	0	0	0
				18	**0**	**11**	**25.5**
Total Contact Hours:29				**Total credits:**		**25.5**	

Semester IV(Second Year)

Sl. No.	Course Code	Course Category & Course Title		L	T	P	Credits
1.	V20EET11	ESC	Control Systems**(CS)**	3	0	0	3
2.	V20ECT07	PCC	Analog& Digital Communication **(ADC)**	3	0	0	3
3.	V20ECT08	PCC	Digital IC Applications**(DICA)**	3	0	0	3
4.	V20ECT09	PCC	Electro Magnetic Waves & Transmission Lines**(EMTL)**	3	0	0	3
5.	V20MBT51	HSS	Managerial Economics &Financial Analysis(**MEFA)**	3	0	0	3
6.	V20CSL33	PCC	Python Programming Lab	0	0	3	1.5
7.	V20ECL04	PCC	Analog & Digital Communication Lab **(ADCLAB)**	0	0	3	1.5
8.	V20ECL05	PCC	Digital IC Applications Lab**(DICA LAB)**	0	0	3	1.5
9.	V20ECSOC02	SOC	Skill Oriented Course	**1**	**0**	**2**	**2**
10	V20ENT03	Mandatory Course	Professional Communication Skills **(PCS-II)**	2	0	0	0
				18	0	11	21.5
Total Contact hours:29				**Total Credits:**		**21.5**	
	Internship 2 Months (Mandatory) during Summer vacation						
	Honors/Minor Courses (The Hours Distribution can be 3-0-2 or 3-1-0 also)			**4**	0	**0**	**4**

*Skill Oriented Course:

The Student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/professional bodies/APSSDC or any other accredited bodies as approved by the concerned BoS.

List of Skill Oriented Courses:

S. No	Name of the Proposed Course
1	PCB Design
2	Programming in Scilab
3	Programming with Arduino
4	Circuit Design & Simulation using Multisim
5	Concepts of Embedded systems
6	Internet of Things
7	Robotics
8	Hands on Graphical Programming Using Lab view

V Semester:

S. No	CourseCode	Course-Category & Course Name		L	T	P	Credits
1	V20ECT10	PCC	VLSI Design	3	0	0	3
2	V20ECT11	PCC	Microprocessors & Microcontrollers	3	0	0	3
3	V20ECT12	PCC	Analog Circuits	3	0	0	3
4	V20ECT13 V20ECT14	PEC	**Professional Elective-I** Antenna &Wave Propagation Information Theory& Coding	3	0	0	3
5		OEC/JOE	**Open Elective-I / Job Oriented Elective**	3	0	0	3
6	V20ECL06	PCC	VLSI Design Lab	0	0	3	1.5
7	V20ECL07	PCC	Microprocessor& Microcontrollers Lab	0	0	3	1.5
8	V20ECSOC03	SOC	Skill Oriented Course	1	0	2	2
9	V20ENT04	MNC	Professional Comm. skills-III	2	0	0	0
10	V20SIMP01	Mandatory	Summer Internship-Mandatory	0	0	0	1.5
				18	**0**	**08**	**21.5**
TOTALContactHours26						**TotalCredits:21.5**	

VI Semester

S.No	Course Code	Course Name	L	T	P	Course-Category	Credits
1	V20ECT15	Digital Signal Processing	3	1	0	Professional Core	3
2	V20ECT16	Microwave Engineering	3	0	0	Professional Core	3
3	V20ECT17	Internet of Things: Use Cases	3	0	0	Professional Core	3
4	V20ECT18 V20ECT19	**Professional Elective-II** Embedded Systems System Design Through VERILOG	3	0	0	Professional Elective	3
5	V20MBT52	Management Science	3	0	0	Humanities& Social Science Elective	3
6	V20ECL08	Digital Signal Processing Lab	0	0	3	Professional Core Lab	1.5
7	V20ECL09	IoT Lab	0	0	3	Professional Core Lab	1.5
8	V20ECL10	Microwave Engg. Lab	0	0	3	Professional Core Lab	1.5
9	V20ENT05	Professional Comm. Skills(Eng+ aptitude) (MNC)- IV	2	0	0	Mandatory & Non Credit	0
10	V20ECSOC04	Skill Advanced Course /Soft Skill Course	1	0	2	Skill Advanced Course / Soft Skill Course	2
		TOTAL	**17**	**1**	**13**		**21.5**

VII Semester

Sl. No.	Course Code	Course Title	Hours per week			Category	Credits
			L	T	P		C
1	V20ECT20 V20ECT21	**Prof. Elective III:** • Digital Image Processing • Computer Networks	3	0	0	Prof. Elective Course	3
2	V20ECT22 V20ECT23	**Prof. Elective IV:** • Cellular Mobile Communication • Low Power VLSI Design	3	0	0	Prof. Elective Course	3
3	V20ECT24 V20ECT25	**Prof. Elective V:** • Radar Engineering • CMOS Digital IC Design	3	0	0	Prof. Elective Course	3
4		**Open Elective-II/Job Oriented Elective**	2	0	2	Open Elective Course	3
5		**Open Elective-III / Job Oriented Elective**	2	0	2	Open Elective Course	3
6		**Open Elective-IV / Job Oriented Elective**	2	0	2	Open Elective	3
7	V20ECSOC05	Skill Advanced Course	1	0	2	Skill Advanced Course	2
8		Industrial Internship-Mandatory after Third Year To be Evaluated during VII Semester	0	0	0	Mandatory	3
		Total	**18**	**0**	**6**		**23**

VIII Semester

Sl. No.	Course Code	Course Title	Hours per week			Category	Credits
			L	T	P		C
1	V20CSP03	Internship/ Industrial Training /Practical training	0	0	4	PRO	2
2	V20CSP04	Major Project (6 Months)	**0**	**0**	**12**	PRO	**6**
		Total	**0**	**0**	**16**		**8**

List of Advanced/ Job Oriented Elective Courses for ECE Students

S. No	Course Code	Name of the Course	Department Offered
1	V20ECTJOC01	FPGA Architecture	Electronics & Communication Engineering
2	V20ECTJOC02	Optical Communications & Networks	
3	V20ECTJOC03	Industrial IOT	
4	V20ECTJOC04	Modern Satellite Communication	
5	V20ECTJOC05	Wireless Sensor Networks	
6	V20ECTJOC06	Digital Signal Processors and Applications	
7	V20ECTJOC07	Modern Wireless Communication Systems	
8	V20ECTJOC08	CMOS Analog IC Design	
9	V20ECTJOC09	Bio Medical Instrumentation	
10	V20ECTJOC10	Speech Signal Processing	
11	V20ECTJOC11	Electronic Instrumentation	
12	V20ECTJOC12	Sensors & Applications	
13	V20ECTJOC13	Deep Learning	
14	V20ECTJOC14	Machine learning	

List of Open Elective Courses

offered to Other Branch Students

S. No	Course Code	Name of the Course	Department Offered
1	V20ECTOE01	Internet of Things	Electronics & Communication Engineering
2	V20ECTOE02	Communication Systems	
3	V20ECTOE03	Principles of Image Processing	
4	V20ECTOE04	Medical Electronics	
5	V20ECTOE05	Principles of Wireless Comm.	
6	V20ECTOE06	Basics of VLSI Design	
7	V20ECTOE07	Concepts of Embedded Systems	

III Semester
SYLLABUS

III Sem.	Electronic Devices Circuits & Analysis	Course Code:V20ECT02	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

- **CO1:** Explain the formation of p-n Junction, Discuss special semi-conductor Diodes & Explain the working principle of rectifiers with and without filters With relevant expressions and necessary comparisons**[K2]**
- **CO2:** Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.**[K2]**
- **CO3:** Explain the need of transistor biasing, various biasing techniques for BJT. **[K2]**
- **CO4:** Analyze small signal low frequency transistor amplifier circuits using BJT In Single & Multistage.**[K2]**
- **CO5:** Explain the operation & Analysis of Feedback and Power amplifiers.**[K2]**

UNIT-I: Junction diode characteristics: p-n junction diode, energy band diagram of PN junction Diode, current components in PN junction Diode, law of junction, derivation of diode equation, V-I Characteristics, Diode resistance, Diode capacitance. Zener Diode, Breakdown mechanisms, UJT, Construction and characteristics

Rectifiers and Filters: Rectifier Classification, characteristics of rectifiers, Filters- Capacitor filter, Inductor filter, derivation for ripple factor in eachcase.

UNIT- II: Transistor Characteristics: BJT: Junction transistor, transistor current components, Transistor equation, Characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Early Effect.

FET: Comparison between BJT and FET.FET types, construction, operation, characteristics, MOSFET- types, construction, operation, characteristics.

UNIT- III: Transistor Biasing &Thermal Stabilization

BJT: Need for biasing, operating point, Load line analysis, BJT biasing- methods, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, Ic, and β,Stability factors(S, S′, S″),Bias compensation.

UNIT-IV: Small Signal Analysis of BJT

Two port network, Transistor hybrid model, determination of h- parameters, Generalized Analysis of CB, CE and CC amplifiers using exact and approximate analysis,Low frequency analysis of Cascade and Cascode amplifiers.

UNIT-V: Feedback Amplifiers, Oscillators & Power Amplifiers

Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies Generalized analysis of Voltage series, current series, voltage shunt, current shunt feedback amplifiers,

Oscillators: Basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge), LC oscillators (Hartley, Colpitts)various classes of operation (Class A, B, AB), power efficiency calculations.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias,TMH.
2. Integrated Electronics- Jacob Millman, C. Halkies, C.D.Parikh,TMH.
3. Electronic Circuit Analysis - B.V.Rao, K.R.Rajeswari, P.C.R.Pantulu, K.B.R.Murthy, Pearson Publications

References:

1. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall.
2. Electronic Circuit Analysis and Design–Donald A.Neaman,McGrawHill.

III Sem.	Probability Theory & Stochastic Processes	Course Code:	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentswill be able to:

CO-1: Explain basic concepts of probability theory through Sets and Relative Frequency **(K2)**

CO-2: Explain the concept of a random variable, functions based on random variable like Distribution and density functions (**K2)**

CO-3: Compute the expected value, moments on one random variable **(K3)**

CO-4: Illustrate the concepts of joint distribution & density functions on multiple random Variables **(K3)**

CO-5: Compute the Temporal and Spectral characteristics of stochastic processes **(K3)**

UNIT I PROBABILITY : Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes Theorem, Independent Events

UNIT II THE RANDOM VARIABLE: Definition of a random variable, Discrete, continuous and mixed random Variables. Distribution & density functions and its properties of a random variable. Binomial, Poisson, Uniform, Gaussian, Exponential and Rayleigh random variables. Conditional distribution and density functions and its properties.

UNIT III OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS: Introduction, expected value of a random variable, function of a random variable, moments about the origin, central moments, variance, characteristic function, moment generating function, transformations of a random variable: Monotonic transformations for a continuous random variable

UNIT IV MULTIPLE RANDOM VARIABLES : Vector random variables, joint distribution function, properties of joint distribution, marginal distribution functions, conditional distribution and density, statistical independence, sum of two random variables, sum of several random variables, central limit theorem: unequal distribution, equal distributions.
OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint moments about the origin, joint central moments, joint characteristic and moment generating functions.

UNIT V RANDOM PROCESSES – TEMPORAL CHARACTERISTICS: The random process concept, classification of processes, deterministic and nondeterministic processes, distribution and density functions, concept of Stationarity and statistical independence. First-order stationary processes, second-order and wide-sense Stationarity, nth-order and strict-sense Stationarity, time averages and Ergodicity, autocorrelation function and its properties, cross-correlation function and its properties, covariance functions.

SPECTRAL CHARACTERISTICS: The power density spectrum: properties, relationship between power density spectrum and autocorrelation function, the cross-power density spectrum, properties, relationship between cross-power density spectrum and cross-correlation function.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S. UnniKrishnaPillai, PHI, 4th Edition, 2002.
3. Probability Theory and Stochastic Processes, Y. Mallikarjuna Reddy, 4th Edition, Universities Press

Reference Books:

1. Probability Theory and Stochastic Processes – B. PrabhakaraRao, BS Publications
2. Probability and Random Processes with Applications to Signal Processing, Henry Stark And John W. Woods, Pearson Education, 3rd Edition.
3. Schaum's Outline of Probability, Random Variables, and Random Processes.
4. An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, 1968.
5. Random Process – Ludeman, John Wiley
6. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill, 2015.

III Sem.	Network Theory	Course Code: V20ECT04	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentswill be able to:

- **CO1:** Apply network theorems to solve the electrical circuits. **[K3]**
- **CO2:** Describe the steady state analysis of RLC circuits. **[K2]**
- **CO3:** Analyze the resonance circuits. **[K4]**
- **CO4:** Solve the two port network parameters. **[K3]**
- **CO5:** Explain RLC transient circuits. **[K2]**

UNIT – I - ELECTRICAL CIRCUITS FUNDEMENTALS AND THEOREMS:
Electric circuits: Network elements classification, Source transformation, Kirchhoff‟s laws, Mesh analysis and Nodal analysis problem solving with resistances only including dependent sources. **Network theorems:** Thevenin‟s, Norton‟s, Milliman‟s, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, - Problem solving using dependent sources also.

UNIT – II - STEADY STATE ANALYSIS OF A.C CIRCUITS
Response to sinusoidal excitation: - pure resistance, pure inductance, pure capacitance, series R-L, R-C, R-L-C circuits, parallel R-L, R-C, R-L-C circuits. Impedance concept, phase angle, problem solving for R-L, R-C and R-L-C circuits using mesh and nodal analysis.

UNIT-III RESONANCE
Series Resonance: resonance frequency, impedance, current, power factor, bandwidth, cutoff frequencies &Q-factor.
Parallel Resonance: resonance frequency, impedance, current, power factor, bandwidth, cutoff frequencies Q-factor. Comparison of series and parallel resonance circuits and solving problems.

UNIT – IV - TWO-PORT NETWORKS
Z-parameters, Y-parameters, Transmission parameters, h-parameters, series connection, Parallel connection, Cascade connection of two port networks. Relationship of two port networks, problem solving

UNIT – V – TRANSIENTS
Initial and final condition in capacitor and inductor, Definition of time constants, R-L, R-C, R-L-C circuits with DC excitation, problem solving using R-L-C elements with DC excitation. Solutions using Laplace transform method.

TEXT BOOKS:
1. Electric Circuit Analysis by Hayt and Kimmarle, TMH.
2. Network Analysis by Van-Valkenberg, PHI.
3. Circuit Theory (Analysis and Synthesis) by ABHIJIT Chakrabarti, DhanpatRai&Co.

REFERENCES:
1. Basic Circuit Analysis by DR Cunninghan, Jaico Publishers.
2. Network Analysis and Filter Design by Chadha, Umesh Publications.
3. Circuits & Network Analysis & Synthesis - A.Sudhakar&Shyam MohanS.Pillai, TMH.

III Sem.	Signals & Systems	Course Code: V20ECT05	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentswill be able to:

- **CO1:** Classify the signals and various operations on signals.**[K2]**
- **CO2:** Determine the response of LTI system to any arbitrary input signal using convolution**[K2]**
- **CO3:** Analyze the spectral characteristics of signals using Fourier series and Fouriertransforms.**[K3]**
- **CO4:** Apply the various sampling techniques on continuous time signals.**[K3]**
- **CO5:** ApplytheconceptsofLaplacetransform/Z-transformtoanalyzecontinuous- time/discrete-timesignalsincomplexplane. **[K3]**

UNIT-I

Signals and Systems: Continuous-time and Discrete-time signals, Transformation soft he independent variable, Exponential and Sinusoidal signals, the unit impulse and unit step functions, Continuous-time and Discrete-time systems and Basic System properties.

UNIT-II

Linear Time Invariant Systems (LTI systems): Discrete-time LTI systems, the convolution sum, Continuous time LTI systems, the convolution Integral, Properties of Linear Time-Invariant Systems.

UNIT-III

Fourier series: Fourier series representation of Continuous-time periodic signals, Convergence of the Fourier series, Properties of Continuous time Fourier series.
Fourier transform: Representation of periodic signals: The Continuous-time Fourier transform, The Fourier transform for periodic signals, Properties of the continuous time Fourier transform.

UNIT-IV

Sampling Theorem: Introduction, Sampling theorem for band limited signals-explanation, NY Quist rate, Reconstruction of a signal from its samples using Interpolation, The effect of under sampling: Aliasing, sampling techniques- impulse, natural and flat top sampling.

UNIT-V

Analysis of Continuous time and discrete time signals using Laplace Transform and Z Transform: The Laplace Transform: The Region of convergence for Laplace transforms, the Inverse Laplace transform, Properties of the Laplace transform. The Z-Transform: The Region of Convergence for the Z-transform, The Inverse Z-transform, Properties of the Z-transform.

TEXT BOOKS:

1. Signals and Systems, A.V. Oppenheim and A.S. Will sky with S. H. Nawab, Second Edition, and PHI Private limited.
2. Signals and Systems, Second Edition, S. Haykin and B. Van Veen, John Wiley & Sons.
3. B.P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.

REFERENCES:

1. R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
2. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007. 40.

3.M.J.Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", Tata McGraw

III Sem.	Electronic Devices, Circuits & Analysis Lab	Course Code: V20ECL01	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentswill be able to:

CO1-Identify, Test and Describe the specifications of various components**. [K2]**

CO2-Interpret the Characteristics of various Semiconductor Devices.**[K2]**

CO3-Sketch the Regulation Characteristics of Zener Diode.**[K3]**

CO4-Examine the Performance of Rectifiers with and without Filters.**[K3]**

CO5-Sketch the Frequency Response of Amplifiers and Compute Bandwidth.**[K3]**

CO6- Construct different RC and LC oscillators using BJT based on the Frequency range. **[K3]**

PART A ELECTRONIC WORKSHOP PRACTICE

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of Active Devices, Diodes, BJTs, JFETs, LEDs,UJT.
3. Study and operation of Ammeters, Voltmeters, Transformers, Analog and digital Multimeter, Function generator, Regulated power supply and CRO.

PART B: List of Experiments

1. PN Junction diode characteristics
2. Zener diode characteristics
3. Rectifier(without and with c-filters)
   - Part-A Half- wave Rectifier
   - Part-B Full- wave Rectifier
4. BJT characteristics (CB Configuration Input & Output characteristics)
5. BJT characteristics (CE Configuration Input & Output characteristics)
6. FET Characteristics (CS Configuration Drain&Transfer Characteristics
7. BJT-CE Amplifier
8. RC Phase Shift Oscillator
9. Colpit's Oscillator
10. Complementary Symmetry Class B Power Amplifier

Equipment required for EDC & Analysis Laboratory

1. Ammeters (Analog or Digital)
2. Voltmeters (Analog or Digital)
3. Active & Passive Electronic Components
4. Regulated Power supplies
5. Cathode Ray Oscilloscopes
6. Analog/ Digital function Generators
7. Digital multimeter
8. Decade resistance Boxes/Rheostats
9. Bread Boards

III Sem.	Signals & Systems Lab	Course Code: V20ECL02	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentswill be able to:

CO1. Understand basics of MATLAB syntax, functions and programming. **[K2]**

CO2. Describe continuous-time and discrete time signals and systems. **[K2]**

CO3. Analyze the spectral characteristics of signals using Fourier analysis. **[K4]**

CO4. Analyze the systems using Laplace transform and Z-transform. **[K4]**

LIST OF EXPERIMENTS:

1. Basic operations on matrices.

2. Generation on various signals and Sequences (periodic and aperiodic), such as unit impulse,

Unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc.

3. Operations on signals and sequences such as addition, multiplication, scaling, shifting,

Folding, computation of energy and average power.

4. Finding the even and odd parts of signal/sequence and real and imaginary part of signal.

5. Convolution between signals and sequences.

6. Auto correlation and cross correlation between signals and sequences.

7. Verification of linearity and time invariance properties of a given continuous /discrete

System.

8. Computation of unit sample, unit step and sinusoidal response of the given LTI system and

Verifying its physical Reliability and stability properties.

9. Gibbs phenomenon.

10. Finding the Fourier transform of a given signal and plotting its magnitude and phase

Spectrum.

11. Waveform synthesis using Laplace Transform.

12. Locating the zeros and poles and plotting the pole zero maps in s-plane and z-plane for the

Given transfer function.

IV Semester
SYLLABUS

IV Sem.	Control Systems	Course Code: V20EET11	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes:

After successful completion of this course, students will be able to:

CO No.	Course Outcome	Knowledge Level
CO1	Determine the mathematical modelling of physical systems	**(K3)**
CO2	Calculation of Time Domain Specification of first and second order systems and understand the effect of Controllers	**(K3)**
CO3	Investigate the stability of closed loop systems using Routh‟s stability criterion and root locus method.	**(K3)**
CO4	Find the stability of control systems using frequency response approaches.	**(K3)**
CO5	Analyze physical systems using state space approach.	**(K4)**

Unit – I: Mathematical Modeling of Control Systems

Classification of control systems, Open Loop and closed loop control systems and their differences, Feed-Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Transfer Function of DC Servo motor - AC Servo motor- Synchro, transmitter and receiver - Block diagram algebra – Representation by Signal flow graph - Reduction using Mason‟s gain formula.

Unit-II: Time Response Analysis

Standard test signals - Time response of first and second order systems - Time domain specifications - Steady state errors and error constants – Effects of various controllers

Unit –III: Stability And Root Locus Technique

The concept of stability – Routh‟s stability criterion –limitations of Routh‟s stability –Root locus concept - construction of root loci

Unit–IV: Frequency Response Analysis

Introduction to Frequency domain specifications-Bode diagrams- transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots, Nyquist Stability criterion. Effects of various controllers.

Unit–V: State Space Analysis of LTI Systems

Concepts of state, state variables and state model, state space representation of transfer function, Diagonalization- Solving the time invariant state equations- State Transition Matrix and it‟s Properties – Concepts of Controllability and Observability.

Text Books:

1. Control Systems principles and design, M. Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition, 2014.
2. Automatic control systems, Benjamin C. Kuo, Prentice Hall of India,2nd Edition, 2014.

Reference Books:

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India, 2002.
2. Control Systems, ManikDhanesh N, Cengage Publications, 2012.
3. Control Systems Engineering, I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition, 2007.
4. Control Systems Engineering, S.Palani, Tata McGraw Hill Publications, 2009.

IV Sem.	Analog & Digital Communication	Course Code: V20ECT07	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentswill be able to:

- **CO1:**Explainthespectralcharacteristics,generationanddetection Techniques of Amplitude modulation techniques**(K2)**
- **CO2:** Explain the spectral characteristics, generation and Detection techniques of angle modulation techniques**(K2)**
- **CO3:**Illustrate different types of noise and predict its effect on Analog communication Systems.**(K3)**
- **CO4:** Describe the generation and detection methods of various digital Modulation schemes.**(K2)**
- **CO5:** Analyze the concepts of error control coding**. (K4)**

UNIT-I

Analog Modulation – Need for modulation, AM, DSB-SC, SSB, VSB - Time domain and frequency domain description, single to NE modulation, power relations, Generation & Detection techniques, AM Transmitters, AM Receivers-Super-heterodyne receiver, IF,AGC.

UNIT-II

Angle Modulation: Phase and Frequency Modulation, Narrow band and Wideband FM, Carson‟s rule, Indirect and direct method of FM generation, Detection of FM, Phase locked loop, Comparison of FM and AM, FM Transmitters, FM Super-heterodyne receiver.

UNIT-III

Noise in Analog Communication system: Noise in DSB &SSB system, Noise in AM system, Noise in Angle Modulation system, Pre-emphasis and de-emphasis.

Pulse Modulation: Time Division Multiplexing, PAM, PWM, PPM-Generation and Detection.

UNIT-IV

Digital Modulation Systems: PulseModulation: Basebandsignals.Samplingprocess ;QuantizationProcess;QuantizationNoise;Pulse-CodeModulation;NoiseConsiderationsinPCMSystems; Differential Pulse-Code Modulation, Delta modulation, adaptive delta modulation, Amplitude, phase and frequency shift keying schemes(ASK,PSK,FSK),introduction to M-array modulation schemes, Matched filter receivers and optimum receiver

UNIT-V

Information theory and Error control Coding: Measure of information, Entropy, Information rate, Source coding theorem, Channel capacity–Shannon-Hartleylaw,control Codes–Linearcodes,Cycliccodes,ConvolutionCoding-encoder, decoder-Exhaustive search and sequential method.

TEXTBOOKS:

1. SimonHaykin and Michael Moher,"AnIntroduction to Analog & Digital Comm unications",2nd Ed.,Wiley,(2007).
2. H Taub& D. Schilling, Gautam Sahe, "Principles of CommunicationSystems", TMH, 3rdEdition,(2007).
3. Tomasi,Wayne,"ElectronicsCommunicationSystems-Fundamentalsthroughadvanced",5thEdition,PearsonEducation,2009
4. Lathi,"ModernDigital&AnalogCommunicationsSystems",2e,OxfordUniversityPress
5. R. P. Singh, S. Sapre, "Communication Systems: Analog and Digital", Tata McGraw-Hill,2nd edition.

REFERENCEBOOKS:

1. BruceCarlson,PaulB.Crillyand Janet C.Rutledge,"Communication Systems:AnIntroductiontoSignalsandNoiseinElectrical Communications", 4thEdition, McGraw-Hill,(2002).
2. SimonHaykin,"CommunicationSystems",4thEdition,John Wiley&Sons,(2001)
3. NevioBenvenuto, Roberto Corvaja, TomasoErseghe, and Nicola Laurenti,"CommunicationSystems:FundamentalsandDesignMethods",JohnWiley&Sons,(2006).
4. SamShanmugam,K,"DigitalandAnalogCommunication Systems",Wileypublisher(2006).

IV Sem.	Digital IC Applications	Course Code:V20ECT08	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentsWill be able to:

- **CO1:** Explain the structure of commercially available digital integrated circuit families. **[K2]**
- **CO2:**Learn the IEEE Standard 1076 Hardware Description Language (VHDL).**[K2]**
- **CO3:** Model complex digital systems at several levels of abstractions, behavioural, Structural, simulation, synthesis and rapid system prototyping.**[K2]**
- **CO4:** Analyze and design basic digital circuits with combinatorial and sequential logic Circuits using VHDL.**[K2]**
- **CO5:**Develop Programmable logic devices and memories with relevant ICs.**[K2]**

UNIT-I

Digital Logic Families and Interfacing: Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behavior, CMOS logic families. Bipolar logic, transistor-transistor logic, TTL families, CMOS/TTL interfacing, Emitter coupled logic.

UNIT-II

Introduction to VHDL: Design flow, program structure, levels of abstraction, Elements of VHDL: Data types, data objects, operators and identifiers. Packages, Libraries and Bindings, Subprograms. VHDL Programming using structural and data flow modeling.

Behavioral Modeling: Process statement, variable assignment statement, signal assignment statement, wait statement , if statement, case statement ,null statement, loop statement, exit statement, next statement ,assertion statement, Inertial Delay Model, Transport Delay Model, Logic Simulation, Logic Synthesis, Inside a logic Synthesizer.

UNIT-III

Combinational Logic Design: Half adder, Full Adder, Ripple Adder, Binary Adder-Subtractor, Look Ahead Carry Generator, ALU, Decoders, encoders, multiplexers and DE multiplexers, parity circuits, comparators, Barrel Shifter, Simple Floating Point Encoder, Dual Priority Encoder, Design considerations of the above combinational logic circuits with relevant Digital ICs, modeling of above ICs using VHDL.

UNIT-IV

Sequential Logic Design: SSI Latches and flip flops, Shift Registers, Universal Shift Registers, Ring Counter, Johnson Counter, Ripple Counter, Design of Modulus N Synchronous Counters, Design considerations of the above sequential logic circuits with relevant Digital ICs, modelling of above ICs using VHDL.

UNIT-V

Memories:
ROM: Internal structure, 2D-Decoding, Commercial ROM types, timing and applications. Static RAM: Internal structure, SRAM timing, standard synchronous SRAMS. Dynamic RAM: Internal structure, timing, synchronous DRAMs.

Text Books:

1. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia,3rd Ed., 2005.

2. VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.

References:

1. Fundamentals of Digital Logic with VHDL Design- Stephen Brown, ZvonkoVranesic, McGraw Hill, 3rd Edition.

IV Sem.	Electro Magnetic Waves & Transmission Lines	Course Code:V20ECT09	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentsWill be able to:

- **CO1:** Find static electric field intensity by using various laws of electrostatics. **[K3]**
- **CO2:**Find static magnetic field intensity by using various laws of magneto staticsand Develop the Maxwell‟s equations for time varying fields**. [K3]**
- **CO3:**Calculate the Propagation Characteristics of the EM Waves in differentmediums And find Brewster angle, critical angle and total internal reflection**. [K3]**
- **CO4:** Compute Primary and Secondary constants for a given transmission line. **[K3]**
- **CO5:** Calculate reflection coefficient, VSWR etc. using smith chart. **[K3]**

Prerequisites: Review of Co-ordinate Systems.

UNIT-I: Electrostatics:

Coulomb‟s Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relation between E and V, Energy Density, Convection and Conduction Currents, Dielectric Constant, Poisson‟s and Laplace‟s Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

UNIT-II: Magneto Statics:

Biot-Savart Law, Ampere‟s Circuital Law and Applications, Magnetic FluxDensity, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductances and MagneticEnergy. Illustrative Problems**.**

Maxwell's Equations (Time Varying Fields):

Faraday‟s Law and Transformer EMF, Inconsistency of Ampere‟s Law and Displacement Current Density, Maxwell‟s Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface.

UNIT-III: EM Wave Characteristics:

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, Relation Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, Good Dielectrics, skin depth, Polarization & Types, Illustrative Problems.

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem.Illustrative Problems.

UNIT-IV: Transmission Lines - I:

Types, Applications of Transmission Lines, Equivalent Circuit, Primary & Secondary Constants, Transmission Line Equations for Finite and Infinite Lines, Characteristic Impedance, Propagation Constant, Phase and Group Velocities, , Lossless lines, Distortion less Lines, Illustrative Problems.

UNIT-V: Transmission Lines – II:

Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; $\lambda/8$, $\lambda/4$ and $\lambda/2$ Lines, Smith Chart – Construction and Applications, Single Stub Matching, Illustrative Problems.

TEXT BOOKS:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.
3. Transmission Lines and Networks – UmeshSinha, SatyaPrakashan (Tech. India Publications), New Delhi, 2001.

REFERENCES:

1. Electromagnetic Fields and Wave Theory –GSN Raju, Pearson Education 2006
2. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006.
3. Electromagnetic Waves andTransmission Lines by Y. Mallikarjuna Reddy, Universities Press

V20MBT51: MANAGEMENT ECONOMICS & FINANCIAL ANALYSIS

(Effective for the students admitted into first year from the Academic Year 2020-2021)
(Common to all Engineering Branches under V20 Regulations)

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

CO1: Understand the basic concepts of managerial economics, demand, and elasticity of demand and methods of demand forecasting. **(K2)**

CO2: Interpret production concept, least cost combinations and various costs concepts in decision making. **(K3)**

CO3: Differentiate various Markets and Pricing methods along with Business Cycles **(K2)**

CO4: Prepare financial statements and its analysis. **(K3)**

CO5: Assess various investment project proposals with the help of Capital Budgeting techniques for decision making. **(K3)**

Unit-I: Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concept ofDemand-Types-Determinants-Law of Demand its Exceptions-Elasticity of Demand-Types andMeasurement- Demand forecasting and its Measuring Methods.

Unit-II: Production and Cost Analysis: Production function-Iso-quants and Iso-cost-Law of Variable proportions- Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Opportunity Cost-Fixed vs Variable Costs-Explicit Costs vs Implicit Costs- Cost Volume Profit analysis- Determination of Break-Even Point- BEP Chart (Simple Problems).

Unit-III: Introduction To Markets, Pricing Policies & forms of Organizations and Business Cycles: Market Structures: Perfect Competition, Monopoly, Monopolistic and Oligopoly – Features – Price, Out- put Determination – Methods of Pricing: Evolution of Business Forms - Features of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises. Business Cycles – Meaning and Features – Phases of Business Cycle.

Unit-IV: Introduction to Accounting & Financing Analysis: Introduction to Double Entry System – Preparation of Financial Statements- Trading Account, Profit & Loss Account and Balance Sheet - Ratio Analysis – (Simple Problems).

Unit-V: Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization- Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting- Traditional and Modern Methods.

TEXT BOOKS

1. Dr. N. AppaRao, Dr. P. Vijay Kumar: „Managerial Economics and Financial Analysis",Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V.Prabhakararao, Prof. P. Venkatarao. „Managerial Economics and FinancialAnalysis", Ravindra Publication.

REFERENCES:

1. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House, 2014.
2. V. Maheswari: Managerial Economics, Sultan Chand.2014
3. Suma Damodaran: Managerial Economics, Oxford 2011.
4. VanithaAgarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui& A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
8. Ramesh Singh, Indian Economy, 7th Edn., TMH2015
9. Pankaj Tandon A Text Book of Microeconomic Theory, Sage Publishers, 2015
10. Shailaja Gajjala and Usha Munipalle, Univerties press, 201

IV Sem.	Analog & Digital Communication Lab	Course Code: V20ECL04	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentswill be able to:

CO-1- Demonstrate the operation of various pulse modulation and demodulation Techniques.**[K3]**
CO-2 -Construct the pre-emphasis and de-emphasis circuits and verify its frequency Response.**[K3]**
CO-3 -Demonstrate the spectrum analysis of modulated signal using spectrum analyser, Operation of AGC and PLL **[K3]**
CO-4- Distinguish the Time division multiplexing and DE multiplexing, Pulse digital Modulation Techniques **[K2]**
CO-5- Distinguish generation and detection of digital modulation techniques **[K2]**
CO-6- Verify the Source encoding and decoding (Huffman Coding) technique and channel Encoding and decoding techniques. **[K3]**

List of Experiments (Twelve experiments to be done)

A. Analog Communications

1. Amplitude Modulation - Mod. &Demod.
2. AM - DSB SC - Mod. &Demod.
3. Spectrum Analysis of Modulated signal using Spectrum Analyser
4. Pre-emphasis & De-emphasis
5. Frequency Modulation - Mod. &Demod, PLL.
6. Sampling Theorem - Pulse Amplitude Modulation - Mod. &Demod.
7. PWM, PPM - Mod. &Demod.

B. Digital Communications

1. Pulse code modulation, Differential pulse code modulation.
2. Delta modulation, Companding.
3. ASK, FSK, PSK.
4. Differential phase shift keying.
5. Source Encoder and Decoder
6. Channel coding-
    i. Linear Block Code-Encoder and Decoder
    ii. Binary Cyclic Code – Encoder and Decoder
    iii. Convolution Code – Encoder and Decoder

IV Sem.	Digital IC Application Lab	Course Code: V20ECL05	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes:

After Successful completion of this course, the studentswill be able to:

CO1: Identify the importance of various tools available in XILINX ISE12.2.**[K2]**
CO2: Develop VHDL/Verilog HDL Source code and perform simulation for various Combinational logic circuits using XILINX ISE12.2.**[K3]**
CO3: Develop VHDL/Verilog HDL Source code and perform simulation for various Sequential logic circuits using XILINX ISE12.2.**[K3]**

Note: The students are required to design and draw the internal logical structure of the following Digital Integrated Circuits and to develop VHDL/Verilog HDL Source code, perform simulation using relevant simulator and analyse the obtained simulation results using necessary synthesizer.

All the experiments are required to verify and implement the logical operations on thelatest FPGA Hardware in the Laboratory.

List of Experiments:

(Minimum of Ten Experiments has to be performed)

1. Realization of Logic Gates
2. Design of Full Adder
3. Design of 3 to 8 Decoder –IC 74138
4. Design of 8 to 3 Encoder (with and without priority)
5. Design of 8 x 1 Multiplexer-IC 74151 and Dual 1x 4 De-multiplexer-IC 74155
6. Design of 4-Bit comparator-IC 7485
7. Design of D-Flip-Flop-IC 7474
8. Design of 4-Bit Ripple Counter.
9. Design of Decade counter –IC 7490
10. Design of Universal Shift register.
11. Design of RAM
12. Design of ALU.

Equipment/Software required:

1. Xilinx Vivado software / Equivalent Industry Standard Software
2. Xilinx Hardware / Equivalent hardware
3. Personal computer system with necessary software to run the programs and Implement.

V Sem.	VLSI Design	Course Code V20ECT10	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Understand different IC technologies. **(K2)**
CO-2: Explain basic electrical properties of MOS, CMOS and Bi-CMOS Circuits. **(K2)**
CO-3: Develop layouts for MOS & Bi-CMOS circuits using design rules. **(K3)**
CO-4: Compute the parameters of MOS circuits and assess the effects of scaling **(K3)**
CO-5: Design Combinational circuits and Subsystems. **(K4)**

UNIT-I:
Review of Microelectronics and An Introduction to MOS technology: Introduction to IC technology, Basic MOS transistors, Enhancement mode MOS transistor Action, Depletion mode MOS transistor Action, NMOS, PMOS fabrication, CMOS fabrication and Bi-CMOS technology, Comparison between CMOS and Bi-CMOS technology.

UNIT-II:
Basic Electrical Properties of MOS and BICMOS Circuits: Ids versus Vds relationships, Aspects of MOS transistor threshold voltage Vt, Trans conductance gm, Output conductance gds and Figure of merit, NMOS inverter, Pull-up to pulldown ratio for NMOS inverter driven by another NMOS inverter and through one or more pass transistors, Alternative forms of pull-up, CMOS inverter, BICMOS inverters, Latch-up in CMOS circuits.

UNIT-III:
MOS and Bi-CMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2μm Double Metal, Double Poly, CMOS/Bi-CMOS rules, 1.2μm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams- Translation to Mask Form.

UNIT-IV:
Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations, The Delay Unit, Inverter Delays, driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers. Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling.

UNIT-V:
Subsystem Design and Layout: Architectural issues, Switch logic, Gate Logic Examples of Structured Design (Combinational Logic): A Parity Generator, Bus Arbitration Logic for n-line-Bus an Illustration of Design Process: Multiplier, Design of an ALU Subsystem, Ripple Carry Adder, and Carry look ahead adder.

Text Books:
1. Essentials of VLSI Circuits and Systems by Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005Edition.

References:
1. –CMOS Digital Integrated Circuits, Analysis And Design‖, Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3rd Edition, 2003.
2. –VLSI Technology‖, S.M. Sze, 2nd edition, Tata McGraw Hill, 2003.

V Sem.	Microprocessors & Microcontrollers	Course Code V20ECT11	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Describe the basic architecture and Modes of 8086 microprocessor **(K2)**
CO-2: Construct assembly language programs for arithmetic and Logical Operations **(K3).**
CO-3: Describe the basic peripherals interfacing and its programming techniques **(K2)**

CO-4: Illustrate the Architecture and features of Intel 8051 Microcontroller **(K3)**

CO-5: Explain the Architecture and features of PIC microcontroller **(K2)**

UNIT-1: **Introduction to Microprocessors**: Evolution of Microprocessors, features, Intel Microprocessor families, Architecture of 8086 microprocessor, pin/signal description, Physical address formation, Description of Minimum and maximum mode pins, Timing diagrams.
Interrupts, Available interrupts, Interrupt Cycle, ISR (Interrupt service Routine).

UNIT-II: **Programming with 8086 Microprocessor**: Various addressing modes of 8086, Instruction set and Classification, Assembler Directives of 8086, writing Assembly language programs using various types of instructions.

UNIT – III: **Interfacing with Basic Peripherals**: Semiconductor memories interfacing (RAM, ROM), Interfacing Microprocessor to keyboards, interfacing to ADC/DAC, Interfacing, 8255(PPI-Parallel I/O port), 8259(Programmable interrupt controller), 8251(serial communication UART), Stepper motor interfacing and programming.

UNIT – IV:**8051 Microcontroller**: Intel 8051 Microcontroller, Microprocessor vs. Microcontroller, 8051 Microcontroller Architecture, Microcontroller 8051 pin diagram, Internal and External Memory, Counters and Timers, Serial Communication in 8051, interrupts in 8051, Addressing Modes, Instruction set, simple programs using microcontroller 8051.

UNIT – V: PIC Microcontroller: Introduction, characteristics of PIC microcontroller, memory organization, parallel and serial input and output, timers, Interrupts, PIC 16F877 architecture, instruction set of the PIC 16F877.

TEXT BOOKS:

1. Advanced microprocessor and Peripherals by A.K.Ray and K.M.Bhurchandi, TMH, 2000.
2. Microprocessors and Interfacing by Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGrawHill Education Private Limited, 3rd Edition.

REFERENCE BOOKS:

1. The Intel Microprocessors-Architecture, Programming, and Interfacing by Barry B.Brey,Pearson, Eighth Edition-2012.

V Sem.	Analog Circuits	Course Code V20ECT12	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Demonstrate Linear wave shaping circuits for various applications. **(K2)**
CO-2: Explain Non-Linear wave shaping circuits for various applications. **(K2)**
CO-3: Explain the operation of non sinusoidal oscillators & Illustrate Op-Amp Characteristics **(K2)**
CO-4: Demonstrate circuits for different applications using ICs. **(K2)**
CO-5: Discuss the operation of Active filters and Data Converters. **(K2)**

Unit I
Linear Wave shaping circuits: Response of high pass and low pass RC circuits to step, pulse inputs. High pass RC circuit as differentiator, low pass RC circuit as integrator.

Unit II
Non Linear Wave Shaping Circuits: Introduction to Clippers, Series and Shunt Clippers, Clippers with reference voltages, Clipping at two independent levels, Series and Shunt Noise Clippers, Positive and Negative Clampers, Clamping Circuits, Clamping Circuit Theorem.

Unit III
Non-sinusoidal oscillators & Introduction to Op-amp: Bistable, Monostable and Astable Multivibrators using BJT . Op-amp Block Diagram, Ideal Op-amp, Equivalent Circuit, Op Amp Characteristics.

Unit IV
Integrated Circuits and applications: open loop op-amp configurations. Inverting and non-inverting amplifier, OP Amp Applicationsr, 555 IC functional block diagram, 555 IC as Astable and Monostable multivibrators.

Unit V
Active filters and Data Converters: First order Low pass, high pass, band pass and band stop filters, All pass filter design guidelines. Weighted resistor DAC, R-2R ladder DAC. Dual slope ADC, Successive approximation ADC, flash ADC.

Text Books:

1. Integrated Electronics- J. Millman and C.C. Halkias, TMH
2. Electronic Devices and Circuits- Salivahanan, N.Suresh Kumar, A. Vallavaraj, TMH
3. Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, TMH

References :

1. Pulse and Digital Circuits – A. Anand Kumar, PHI
2. Linear Integrated Circuits – D. Roy Choudhury, 4th edition, New Age International (p) Ltd.
3. Op-Amps & Linear Integrated Circuits - Ramakanth A. Gayakwad,3rd edition, PHI.

V Sem.	Antenna &Wave Propagation (Professional Elective-I)	Course Code V20ECT13	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Understand the radiation mechanism and fundamental parameters of antenna **(K2)**
CO-2: Solve the field components of dipole (or quarter monopole), loop antenna and their characteristics. **(K3)**
CO-3: Solve array factor for N element linear array and directivity & Design the Microwave antennas. **(K3)**
CO-4: Demonstrate the measurement procedure for antenna parameters, develop the rectangular Microstrip antenna and understand the concepts of modern antennas. **(K3)**
CO-5: Explain the concept of propagation methods and fading in wave propagation. **(K2)**

UNIT I

ANTENNA FUNDAMENTALS: Introduction, Radiation Mechanism – single wire, two wires, Dipoles, Current Distribution on a thin wire antenna. Antenna Parameters –Near and far field regions, Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam width, Polarization, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, Reciprocity Theorem applicable to antennas, Simple Problems.

UNIT II

WIRE ANTENNAS: Retarded Potentials, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Evaluation of Electric and magnetic Field Components, Radiation Resistance, Beam-width, Directivity.

Loop Antennas: Small Loops - Concept of short magnetic dipole - Field Components, Comparison of far fields of small loop and short dipole, Helical Antennas – Significance, Geometry, basic properties.

UNIT III

ANTENNA ARRAYS: Two element arrays, N element Uniform Linear Arrays – Broadside Array, End-fire Array, Array factor, Derivation of their characteristics and comparison, Principle of Pattern Multiplication, Non Uniform arrays- Binomial arrays, Phased Arrays concept - Beam scanning, Applications.

MICROWAVE ANTENNAS: Parabolic Reflectors – Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds & Cassegrain Feeds. Horn Antennas – Types, design Characteristics of Pyramidal Horns.

UNIT IV

ANTENNA MEASUREMENTS – Block diagram of radiation pattern measurement setup and measurement procedure, Distance Criterion, Indoor and outdoor measurement- Far field measurement, Advantages. Gain Measurements and measurement procedure (Comparison of Absolute and 3-Antenna Methods).

MODERN ANTENNAS: Microstrip Antennas - Geometry, Features, Advantages and Limitations, Rectangular MSA Design, Radiation mechanism, Simple design problems. Smart antennas - Block diagram, concept, switched beam and adaptive array concept & MIMO antennas.

UNIT V

WAVE PROPAGATION AND TRENDS IN WIRELESS COMMUNICATION: Concepts of Propagation - frequency ranges and types of propagations. Ground Wave-Propagation characteristics, Fundamental Equation for Free - Space Propagation, Basic Transmission Loss Calculations, Space Wave Propagation - Mechanism, LOS and Radio Horizon, Tropospheric Wave Propagation – Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations. Fading - Types of fading, Multipath propagation.

TEXT BOOKS

1. Antennas for All Applications by John D. Kraus and Ronald J. Marhefka, 3rd Edition, TMH, 2003.
2. Electromagnetic Waves and Radiating Systems by E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.
3. Broadband Microstrip Antenna by Girish Kumar, Artech house Publishers

REFERENCES

1. Antenna Theory by C.A. Balanis, John Wiley and Sons, 2nd Edition, 2001.
2. Antennas and Wave Propagation by K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Antennas and Wave Propagation by Sisir K Das and Annapurna Das – Tata McGraw Hill.

V Sem.	Information Theory & Coding (Professional Elective-I)	Course Code V20ECT14	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1. Analyze the properties of Information theory **[K4]**
CO2. Evaluate Source coding efficiencies for different discrete sources **[K4]**
CO3. Apply various source coding techniques for data compression **[K3]**
CO4. Analyze linear block code encoding and decoding techniques **[K4]**
CO5. Analyze cyclic and convolutional code encoding and decoding techniques **[K4]**

UNIT I

INFORMATION THEORY : Introduction, Types of Information sources, Discrete messages, Concept of amount of information and its properties, Average information, Entropy and its properties, Information rate, Mutual information and its properties, Classification of Channels-Binary symmetric Channel, Binary Erasure Channel, Channel Matrices for different Channels.

UNIT II

CHANNEL CAPACITY & SOURCE CODING : Shannon-Hartley Theorem, Channel capacity of analog and discrete Channels, Capacity of a Gaussian channels, bandwidth –S/N trade off, Introduction to source coding, Shannon's source coding theorem, Prefix, Variable, & Fixed-Length Codes, Shanon-Fano coding, Huffman coding, Non-binary Huffman coding, Coding efficiency calculations.

UNIT III

DATA COMPRESSION : Basic Concepts of data compression, Run Length Coding, Block Sorting Compression, Dictionary Coding- Lempel Ziv algorithm, Statistical Compression, Prediction by Partial Matching, Arithmetic Coding, Adaptive Huffman Coding, Comparison of Huffman coding and Adaptive Huffman Coding.

UNIT IV

LINEAR BLOCK CODES : Introduction to channel coding, Classification of channel coding techniques-Error detection and correction codes, Systematic and Nonsystematic codes, Matrix description of Linear Block codes, Encoding using Generator Matrix, Syndrome Calculation, Decoding of linear block codes, Error detection and error correction capabilities of linear block codes.

UNIT V

BINARY CYCLIC CODES: Introduction, Polynomial Representation of Code words, Generator Polynomial, Systematic cyclic codes, Encoder design, Syndrome Calculation, Error Detection, Decoder design, and Limitations of Cyclic Codes.

CONVOLUTIONAL CODES: Introduction, Encoder Design, Encoding-Time Domain, Graphical approach: state, tree and trellis diagram, Decoding of Convolutional Codes-Viterbi algorithm, Sequential Decoding, Advantages and Limitations of Convolutional codes.

TEXT BOOKS:

T1. John G Proakis, -Digital Communications‖, Mc Graw-Hill, 4th ed, 2000.

T2. Carlson A. Bruce, -Communication Systems‖, 4th Edition, Mc. Graw Hill Publishers, 2002.

REFERENCES:

R1. Roberto Togneri, Christopher J.S. Desilva, -Fundamentals of Information Theory and Coding Design‖, CRC Press, Taylor & Francis, 2006.

R2. Taub &Schilling, -Principles of Communication Systems‖, 2nd Edition, McGrawHill Publishing Company.

V Sem.	VLSI Design Lab	Course Code V20ECL06	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Explain the VLSI Design Methodologies using Mentor Graphics Tools **(K2)**
CO-2: Demonstrate significance of various CMOS Analog and Digital circuits in Full-custom IC Design flow **(K2)**
CO-3: Explain the Physical Verification in Layout Design **(K2)**
CO-4: Design and analyse of Analog and mixed signal simulation **(K3)**
CO-5: Analyse the Significance of Pre-Layout Simulation and Post-Layout Simulation. **(K4)**

PART-A List of Experiments: Design the following experiments using 250nm CMOS technology and extract parasitic.

1. CMOS Inverter
2. Universal Logic gates
3. Full Adder
4. RS-Latch & D- latch
5. JK-Flip Flop
6. Ripple Carry Adder
7. Asynchronous Counter
8. Ring Oscillator
9. R-2R Ladder Type DAC
10. Differential Amplifier
11. 2–3-week Mini Project. Lab Requirements: Software: Mentor Graphics – Pyxis Schematic, IC Station, Calibre, ELDO Simulator

V Sem.	Microprocessor & Microcontrollers Lab	Course Code	L	T	P	C
		V20ECL07	0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Develop algorithm and logic for different operations using 8086 Instructions. **(K3)**
CO-2: Construct simple programs for 8086 using Assembler directives (MASM)/Machine control Instructions. **(K3)**
CO-3: Develop ALP to perform arithmetic and logical operations using various instructions. **(K3)**
CO-4: Develop ALP to perform conversions, finding squares of a numbers by using Loop, Jump instructions. **(K3)**
CO-5: Develop Assembly language programs for 8051 Micro controller. **(K3)**

LIST OF EXPERIMENTS

PART- A:
8086 Assembly Language Programming using Assembler Directives
Introduction to MASM/TASM

1. Basic Arithmetical operations – Unsigned Addition, Subtraction, Multiplication and Division.
2. Multi byte addition/subtraction
3. Sorting of given array of elements (Ascending order /descending order)
4. Sum of squares/cubes of a given n-numbers
5. Shift and rotate operations for given number.

PART- B: 8051 Assembly Language Programming

6. Assembly Language program to find average of n numbers by 8051 microcontrollers.
7. Assembly Language program to find the no of 1's and 0's in a given number by 8051 Microcontroller.
8. Assembly language program in 8051 micro controllers for Counter 0 in Mode 2 to count the number of pulses and display the count value on port P2 and external memory location 0FFC1H.
9. Assembly language program for serial transmission and serial reception with an baud rate of 9600bps.
10. Assembly Language program to interface stepper motor to 8051 microcontroller (Both directions)

VI-Semester

Syllabus

(V20 Regulation)

VI Sem.	Digital Signal Processing	Course Code V20ECT15	L	T	P	C
			3	1	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Classify Discrete Time Signals & systems, Compute DFT for discrete Time signals. **(K3)**
CO-2: Compute DFT for discrete Time signals using FFT Algorithm **(K3) CO-3:** Describe the various implementations of digital filter structures **(K2)**
CO-4: Analyze and design a Digital filter (FIR&IIR) from the given specifications **(K4)**
CO-5: Use the Multi-rate Processing concepts in various applications **(K3)**

UNIT I- INTRODUCTION & DISCRETE FOURIER TRANSFORMS: Classification of Discrete time signals & Systems, stability of LTI systems. Introduction to DTFT**,** Discrete Fourier transforms, Properties of DFT.

UNIT II- INTRODUCTION & FAST FOURIER TRANSFORMS Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT III- REALIZATION OF DIGITAL FILTER: Review of Z-transform, digital filters, Block diagram representation of linear constant coefficient difference equations, Basic structures of IIR systems, Transposed forms. Basic structures of FIR systems.

UNIT IV- DESIGN OF IIR and FIR DIGITAL FILTERS: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from Analog filters, Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters.

UNIT V- MULTIRATE DIGITAL SIGNAL PROCESSING: Introduction, Decimation, Interpolation Sampling rate conversion, Implementation of sampling rate converters**,** Applications – Sub-band Coding of Speech Signals, Introduction to architecture of TMS320C5X DSP processors.

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications by John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing by A.V.Oppenheim and R.W. Schaffer, PHI
3. Digital Signal Processing by Ramesh babu, Sci Tech publications

Reference Books:

1. Digital Signal Processing by MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
2. Digital Signal Processing by Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006
3. Digital Signal Processing by A.Nagoor Kani, RBA Publications.

VI Sem.	Microwave Engineering	Course Code: V18ECT16	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes:

After Successful completion of the Course, the student will be ableto:

CO1: Solve the TE/TM modes and characteristics of Rectangular waveguide **(K2)**
CO2: Illustrate the construction, operation, Power output and efficiency of two cavity Klystron Amplifier and Reflex klystron Oscillator **(K3)**
CO3: Examine the construction, operational details of travelling wave tube Amplifier & cylindrical cavity Magnetron Oscillator **(K4)**
CO4: Construct the various passive waveguide components based on the Scattering matrix **(K3)**
CO5: Explain the operation of Microwave Solid State Devices & the procedure for measuring various microwave parameters using a Microwave test bench **(K2)**

UNIT I
MICROWAVE TRANSMISSION LINES: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides (RWG) – Solution of TE and TM wave equation in RWG - Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations & Characteristics, Cavity resonators – Rectangular cavity resonator – Dominant mode – Resonant frequency – related problems.

UNIT II
MICROWAVE TUBES (O type): Limitations and Losses of conventional tubes at microwave frequencies. Re-entrant cavities, Microwave tubes – O type and M type classifications. O-type tubes: 2 Cavity Klystrons – Structure, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory –Expressions for o/p Power and Efficiency, Applications, Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Bunching Process, Power Output, Efficiency, Applications, Related Problems.

UNIT III
HELIX TWTS: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Suppression of Oscillations, Nature of the four Propagation Constants.

M-type Tubes Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – operation, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics.

UNIT IV MICROWAVE PASSIVE COMPONENTS: Waveguide Attenuators- Waveguide phase shifters. Scattering Matrix – Significance - Formulation and Properties. E plane Tee - H plane Tee – Magic Tee - Directional coupler operation and Scattering Matrix Calculation. Ferrite Components- Faraday rotation - Isolator and Circulator.

UNIT V
MICROWAVE SOLID STATE DEVICES: TEDs – Introduction, Gunn Diode – Principle - RWH Theory – Characteristics - Basic Modes of Operation - Oscillation Modes. Avalanche Transit Time Devices – IMPATT Diode – Principle of Operation and characteristics. Detector Diode, PIN Diode characteristics and applications.

MICROWAVE MEASUREMENTS: Description of Microwave Bench – Different Blocks and their Features, Precautions. Microwave Power Measurement using Bolometer Method. Measurement of Attenuation, VSWR and Impedance.

TEXT BOOKS:

1. Microwave Devices and Circuits by Samuel Y. Liao, PHI, 3rd Edition, 1994.
2. Foundations for Microwave Engineering by R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
3. –Microwave Engineering‖ by David M.Pozar, Fourth Edition, Wiley, India 2012.

REFERENCES:

1. Microwave and Radar Engineering by M.Kulkarni, Umesh Publications, 3rd Edition.
2. Microwave Engineering by G S N Raju, I K International
3. Microwave and Radar Engineering by G Sasibhushan Rao Pearson

VI Sem.	Internet of Things: Use Cases	Course Code V20ECT17	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe M2M and IOT Technologies. **[K2]**
CO2: Explain the layers and protocols in IOT. **[K2]**
CO3: Describe various communication technologies used in IOT. **[K2]**
CO4: Illustrate various hardware components required for IOT applications. **[K2]**
CO5: Discuss the cloud technologies and their services and explain the IoT Applications. **[K2]**

UNIT I – INTRODUCTION [1]
Introduction from M2M to IoT - An Architectural Overview, building architecture, Main design principles and needed capabilities, An IoT architecture outline, M2M and IoT Technology Fundamentals - Devices and gateways.

UNIT II – IOT PROTOCOLS [2]
Functionality of Layers in IoT –Study of protocols - Wireless HART, Z-Wave, 6LoWPAN, RPL, CoAP, MQTT.

UNIT III - COMMUNICATION TECHNOLOGIES IN IOT [2, 4]
IoT Connectivity – IEEE 802.15.4, Zigbee, LPWAN, Wi-Fi, Bluetooth, 5G Era.

UNIT IV - SYSTEM HARDWARE [3, 4]
Sensors, Actuators, Radio Frequency Identification, Introduction to Embedded Devices for IoT - RASPBERRY PI, Beaglebone black.

UNIT V – Cloud Computing [3, 4]
Data Collection, Storage and Computing Using a Cloud Platform for IoT Applications/ Services. Use Cases - Smart and Connected Cities, Agriculture, and Healthcare.

TEXTBOOKS:

1. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1st Edition, Academic Press, 2014.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Cisco Press 800 East 96th Street Indianapolis, Indiana 46240 USA.
3. -Internet of Things (A Hands-on- Approach)‖, Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2014.

Internet of Things - By Raj Kamal, McGraw-Hill Education. Copyright.

REFERENCE BOOKS:

1. From Internet of Things to Smart Cities: Enabling Technologies - edited by Hongjian Sun, Chao Wang, Bashar I. Ahmad, CRC Press -2018.
2. Bernd Scholz-Reiter, Florian Michahelles, -Architecting the Internet of Things‖, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT, David Etter.

VI Sem.	Embedded Systems (Professional Elective-II)	Course Code V20ECT18	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe the Basic Concepts of Embedded Systems- **(K2).**
CO2: Describe the characteristics of Application & Domain-Specific Embedded Systems – **(K2)**
CO3: Discuss various hardware design approaches in embedded environment- **(K2)**
CO4: Describe various Embedded firmware design approaches on Embedded environment. **(K2)**
CO5: Illustrate the development, implementation & testing of Embedded System. **(K3)**

UNIT-I:
INTRODUCTION: Embedded System -Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, List of Communication Interface.

UNIT-II:
Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

UNIT-III:
EMBEDDED HARDWARE DESIGN: Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

UNIT-IV:
EMBEDDED FIRMWARE DESIGN: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT-V:
EMBEDDED SYSTEM DEVELOPMENT, IMPLEMENTATION AND TESTING: The integrated development environment, Types of files generated on cross-compilation, Deassembler/De-compiler, Simulators, Emulators and Debugging, Target hardware debugging, Embedded Software development process and tools, Interpreters, Compilers and Linkers, debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

Text Books:
1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.

References:
1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B.Das-Pearson Publications,2013.

VI Sem.	SYSTEM DESIGN THROUGH VERILOG (Professional Elective-II)	Course Code	L	T	P	C
		V20ECT19	3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Outline basic concepts, constructs and conventions of VERILOG. **(K2)**
CO2: Develop Verilog codes for combinational and sequential logic cirucits at gate and data flow level. **(K3)**
CO3: Develop Verilog codes for combinational and sequential logic circuits at behavioral level. **(K3)**
CO4: Develop Verilog codes for CMOS circuits at switch level and outline the concepts of task, function and complier directives. **(K3)**
CO5: Explain Synthesize of Combinational and Sequential Circuits. **(K2)**

UNIT-I

INTRODUCTION TO VERILOG:
Verilog as HDL, Levels of design description, concurrency, module, simulation and synthesis, test bench, functional verification, programming language interface (PLI), simulation and synthesis tools.
LANGUAGE CONSTRUCTS AND CONVENTIONS:
Introduction, keywords, identifiers, whitespace characters, comments, numbers, strings, logic values, data types, scalars and vectors, parameters, memory, operators.

UNIT-II
GATE LEVEL MODELLING:
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, delays, strengths and contention resolution, net types, design of basic circuits.
DATA FLOW LEVEL MODELLING
Introduction, continuous assignment structures, delays and continuous assignments, assignment to vectors, design of basic circuits.

UNIT-III
BEHAVIORAL MODELLING:
Introduction, operations and assignments, initial construct, always construct, examples, assignments with delays, wait construct, multiple always blocks, blocking and non-blocking assignments, the case statement, if and if else constructs, assign-De assign construct, repeat construct, FOR loop, the disable construct, While loop, Forever loop, parallel blocks, force-release construct, event.

UNIT-IV
SWITCH LEVEL MODELLING
Basic transistor switches, CMOS switch, Bidirectional gates and time delays with switch primitives, instantiations with strengths and delays, strength contention with trireg nets, switch level modeling for NAND, NOR and XOR.

SYSTEM TASKS, FUNCTIONS, AND COMPILER DIRECTIVES:
Introduction, System Tasks and Functions, File based Tasks and Functions, Compiler Directives, Hierarchical Directives, User-defined Primitives (UDP).

UNIT-V

SYNTHESIS OF COMBINATIONAL AND SEQUENTIAL LOGIC USING VERILOG:
Synthesis of combinational logic: Net list of structured primitives, a set of continuous assignment statements and level sensitive cyclic behavior with examples, Synthesis of priority structures, exploiting logic don't care conditions. Synthesis of sequential logic with latches: Accidental synthesis of latches and Intentional synthesis of latches, Synthesis of sequential logic with flip-flops, Synthesis of explicit state machines.

TEXT BOOKS:
1. Design through Verilog HDL — T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press, 2004.
2. Advanced Digital Design with Verilog HDL — Michael D. Ciletti, PHI, 2005.

REFERENCES:
1. Fundamentals of Logic Design with Verilog — Stephen. Brown and Zvonko Vranesic, TMH, 2005.
2. A Verilog Primier — J. Bhasker, BSP, 2003.

VI Sem.	Digital Signal Processing Lab	Course Code V20ECL08	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Describe the generation and convolution of discrete time signals **(K2)**
CO-2: Compute the DFT using FFT **(K3)**
CO-3: Design Digital IIR and FIR filter **(K4)**
CO-4: Develop Interpolator and Decimator **(K3)**
CO-5: Apply DSP algorithms for audio and Image processing applications **(K3)**
CO-6: Develop DSP algorithms on TMS320C6713 DSP processor Kit **(K3)**

List of Experiments (Any 6 Experiment from PART-A and PART-B):

PART – A

1. Generate the varies discrete time signals.
2. Perform linear & circular convolution of given sequences
3. Obtain a 4-point and 8-point DFT of a givensequence.
4. Determine the 4-point and 8-point DFT using FFT.
5. Design and Simulate Infinite Impulse Response (IIR) filters using butter worth and Chebyshev filters.
6. Design and simulate Finite Impulse Response (FIR) filters using windowing techniques.
7. Compute Interpolation and Decimation of given signal and find their spectrum.

PART – B (DSP Applications)

1. Read a .wav file and plot time domain waveform of a speech signal
2. Compute the histogram of the given image.
3. Compute the edge of an image using spatial filters.
4. Compute the two-level Decomposition of Discrete Wavelet transforms and Reconstruct image using inverse Discrete Wavelet transform
5. Obtain linear & circular convolution of two signals using TMS320C6713 DSP processor.
6. Obtain Power Spectral Density of a periodic signal using TMS320C6713 DSP processor.
7. Design and simulate Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters using TMS320C6713 DSP processor.

VI Sem.	IoT Lab	Course Code V20ECL09	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:
CO1: Develop Embedded C Program to interface sensors & actuators. **(K3)**
CO2: Develop Embedded C Program to send the sensor data to cloud. **(K3)**
CO3: Develop Wireless Module Interface with Embedded device. **(K3)**
CO4: Develop street light control system, security system, home automation system. **(K4)**
CO5: Develop mobile application to interface with embedded device. **(K3)**

List of Experiments (any 10 Experiments)

1. Write an Embedded C Program to interface the following with Arduino Uno with IR Sensor, Temperature Sensor, Ultrasonic Sensor
2. Write an Embedded C Program to Interface DC Motor, Servo/stepper Motor with Arduino Uno.
3. Write an Embedded C Program to Interface LCD with Arduino Uno.
4. Develop an Application to Interface GPS with Arduino and Identify Latitude and Longitude
5. Wireless Module Interface – Bluetooth with Arduino Uno.
6. Wireless Module Interface – Zigbee with Arduino Uno as transceiver.
7. Write an Embedded C Program to monitor temperature and humidity and store in cloud usingWi-Fi Module.
8. Read data from sensor and send it to a requesting client using socket communication. Note: The client and server should be connected to same local area network.
9. Home security System using Raspberry-pi and PIR Sensor.
10. LED Control and LDR interfacing with Raspberry-pi.
11. Uploading sensor Data to cloud With MQTT protocol.
12. Interfacing Raspberry-pi with the smart phone for enabling home automation.

REFERENCE BOOKS:

1. From Internet of Things to Smart Cities: Enabling Technologies - edited by Hongjian Sun, Chao Wang, Bashar I. Ahmad, CRC Press -2018.
2. Bernd Scholz-Reiter, Florian Michahelles, -Architecting the Internet of Things‖, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT, David Etter.
4. -Internet of Things (A Hands-on- Approach)‖, Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2014.

VI Sem.	Microwave Engineering Lab	Course Code V20ECL10	L	T	P	C
			0	0	3	1.5

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Sketch the characteristics of various Microwave & Optical sources **(K3)**

CO2: Compute the various Parameters of Microwave & Optical Components **(K3)**

CO3: Measure the radiation pattern of Horn antenna and reflector antenna. **(K5)**

CO4: Analyze a rectangular micro strip patch antenna using HFSS software **(K4)**

Minimum Twelve Experiments to be conducted:

Part – A (Any 7 Experiments):

1. Reflex Klystron Characteristics.
2. Gunn-Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. Frequency and Waveguide Parameters Measurement.
6. Impedance and Measurement.
7. Scattering parameters of Magic Tee.
8. Scattering parameters of Circulator.
9. Radiation Pattern of Horn and Parabolic Antennas.
10. Synthesis of Microstrip antennas (Rectangular Structure) Using HFSS.

Part – B (Any 5 Experiments):

11. Characterization of LED.
12. Characterization of Laser Diode.
13. Intensity modulation of Laser output through an optical fiber.
14. Measurement of Data rate for Digital Optical link.
15. Measurement of NA.
16. Measurement of losses for Analog Optical link.

VII-Semester Syllabus

(V20 Regulation)

VII Sem.	Digital Image Processing (Professional Elective-III)	Course Code V20ECT20	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1. Explain image fundaments and the different image Transforms Techniques **(K2)**
CO2. Describe Spatial and frequency domain filtering like smoothing and sharpening operations on Images **(K2)**
CO3. Describe Restoration operations/techniques on Images **(K3)**
CO4. Describe the Image compression Techniques and Image segmentation **(K3)**
CO5. Explain the different color models and color image processing techniques **(K2)**

UNIT-I

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.

Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of two variables, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform.

UNIT-II

Intensity Transformations and Spatial Filtering: Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, and sharpening spatial filters.

Filtering in the Frequency Domain:, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters and Selective filtering.

UNIT-III

Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Estimating the image degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, geometric mean filter.

UNIT-IV

Image compression : Fundamentals, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding,Image pyramids and subband coding.

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region based segmentation and .simple morphological operations Erosion and dilation,opening and closing.

UNIT-V

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color.

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar,‖ Digital Image Processing‖, Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, -Fundamentals of Digital Image Processing‖, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, -Digital Image Processing and Analysis‖, PHI, 2009.

VII Sem.	Computer networks (Professional Elective-III)	Course Code V20ECT21	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1: Discuss fundamentals of network concepts, Reference Models and physical layer. **(K2)**
CO2: Demonstrate Error control and protocols. **(K3)**
CO3: Apply Routing algorithms and congestion control algorithms. **(K3)**
CO4: Discuss Transport layer services and protocols. **(K2)**
CO5: Describe Application layer protocols. **(K2)**

UNIT-I:
Introduction: Reference models: The OSI Reference Model- the TCP/IP Reference Model, Examplesof Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN.

Physical Layer: Transmission Media, Multiplexing: FDM, WDM and TDM- LAN Technologies, introduction to switching: Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT–II:
Data link layer: Design issues, Framing, Flow control, error control, error detection and correction, CRC, Checksum: idea, one's complement internet checksum, MAC: ALOHA, CSMA. Elementary Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. Sliding window protocol: One bit, go back N, Selective repeat-Stop and wait protocol, HDLC, point to point protocol (PPP).Piggybacking.

UNIT-III:
Network Layer : Network layer design issues- Algorithm shortest path routing, Flooding, Hierarchical routing, Broad cast, Multi cast Routing algorithms Congestion control and algorithms, Internet Protocol (IP) Addresses, Subnet masking

UNIT–IV:
Transport Layer: Services, Primitives and sockets, Elements of transport protocols, Internet Transport protocols(TCP,UDP,RPC,RTTP/RTP,RTCP) Segment headers, Primitives, Control, Congestion control, Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT–V:
Application Layer: DNS, SMTP, POP, & FTP HTTP Presentation formatting. Network security: Introduction to Cryptography, Authentication, Basics of Public key and private key cryptography, digital signatures and certificates firewalls and wireless security.

TEXT BOOKS:

1. Computer Networks by Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networks by Behrouz A. Forouzan.Third Edition TMH

REFERENCES:

1. An Engineering Approach to Computer Networks by S.Keshav, 2nd Edition, Pearson Education
2. Understanding Communications and Networks, 3rd Edition by W.A. Shay, Thomson

VII Sem.	Cellular Mobile Communication (Professional Elective-IV)	Course Code V20ECT22	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1: Demonstrate the limitations of conventional mobile telephone systems; understand the concepts of cellular systems. **[K2]**
CO2: Illustrate the concept of frequency Reuse channels, deduce Co- channel Interference reduction factor **[K2]**
CO3: Understand the frequency management, channel assignment strategies and Antennas in cellular systems.**[K2]**
CO4: Discuss the concepts of Handoff, dropped calls and cell splitting, Intersystem Handoff. **[K2]**
CO5: Explain the knowledge about different multipleacess schemes, GSM architecture and higher generation cellular standards,.**[K2]**

UNIT-I
CELLULAR MOBILE RADIO SYSTEMS: Introduction to Cellular Mobile System, uniqueness of mobile radio environment, operation of cellular systems, consideration of the components of Cellular system, Hexagonal shaped cells, Analog and Digital Cellular systems.
CELLULAR CONCEPTS: Evolution of Cellular systems, Concept of frequency reuse, frequency reuse ratio, Number of channels in a cellular system, Cellular traffic: trunking and blocking, Grade of Service; Cellular structures: macro, micro, pico and femto cells; Cell splitting, Cell sectoring.

UNIT-II
INTERFERENCE: Types of interferences, Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, design of Antenna system, antenna parameters and their effects, diversity receiver, non-cochannel interference-different types.

UNIT-III
FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT: Numbering and grouping, setup access and paging channels, channel assignments to cell sites and mobile units: fixed channel and non-fixed channel assignment, channel sharing and borrowing, overlaid cells. CELL COVERAGE FOR SIGNAL AND TRAFFIC: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, straight line path loss slope, and 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-IV
HANDOFF STRATEGIES Concept of Handoff, types of handoff, handoff initiation, delaying handoff, forced handoff, mobile assigned handoff, intersystem handoff, vehicle locating methods, dropped call rates and their evaluation.

UNIT-V
DIGITAL CELLULAR NETWORKS: GSM architecture, GSM channels, multiple access schemes; FDMA, TDMA, CDMA, OFDMA;
HIGHER GENERATION CELLULAR STANDARDS: 3G System architecture (UMTS) enhancements in 4G standard, Architecture and representative protocols, introduction to 5G.

TEXTBOOKS:
1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn,2006.
2. Principles of Mobile Communications – Gordon L. Stuber, Springer International 2nd Edition, 2007.

REFERENCES:
1. Wireless Communications – Theodore. S. Rapport, Pearson education, 2nd Edn, 2002.
2. Wireless and Mobile Communications – Lee McGraw Hills, 3rd Edition, 2006. 3. Mobile Cellular Communication – G Sasibhushana Rao Pearson
3. Wireless Communication and Networking – Jon W. Mark and WeihuaZhqung, PHI, 2005.

VII Sem.	Low Power VLSI Design (Professional Elective-IV)	Course Code V20ECT23	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1: Illustrate the importance of low power design, sources of power dissipation and the factors affecting them. **[K3]**
CO2: Describe various power reduction techniques possible for Low-Power Design at different levels. **[K2]**
CO3: Analyze various adder structures for low power applications. **[K4]**
CO4: Analyze various multipliers and multiplication algorithms for low voltage and low power environment. **[K4]**
CO5: Discuss the techniques for attaining the low power consumption in memories. **[K2]**

UNIT-I:
Fundamentals of Low Power VLSI Design: Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT-II:
Low-Power Design Approaches:
Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches.
Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

UNIT-III:
Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques –Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

UNIT-IV:
Low-Voltage Low-Power Multipliers Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT-V:
Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

Text Books:
1. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.

Reference Books:
1. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons, 2000.
2. CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 2011.

VII Sem.	Radar Engineering (Professional Elective-V)	Course Code V20ECT24	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1: Demonstrate the factors which affecting the radar performance using Radar Equation. **[K2]**

CO2: Describe the operation of CW and FMCW Radar systems. **[K2]**

CO3: Illustrate the principle of each and every block of MTI Radar **[K2]**

CO4: Distinguish the different methods used for tracking targets. **[K2]**

CO5: Illustrate the basic principle and the importance of Matched Filter Receivers in Radars **[K2]**

UNIT–I:

Basics of Radar: Introduction, Maximum Unambiguous Range, simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications.

Radar Equation : Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, SNR, Probability of Detection, Probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses.

UNIT–II:

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar.

FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FMCW altimeter, Multiple Frequency CW Radar.

UNIT-III:

MTI Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and 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.

UNIT –IV:

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns.

UNIT –V:

Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Detection and Cross-correlation Receiver, Matched Filter with Non-white Noise, Noise Figure and Noise Temperature.

Radar Receivers: Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers.

TEXT BOOKS:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Edition,2007.
2. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.
3. Radar Engineering – GSN Raju, IK International.

REFERENCE BOOKS:

1. Introduction to Radar Systems, 3rd edition – M.I. Skolnik, TMH Ed., 2005.
2. Microwave & Radar Engineering – M. Kulkarni, Umesh Publications, 3rd edition
3. Microwave & Radar Engineering – G. SasibhushanaRao, Pearson Publications

VII Sem.	CMOS DIGITAL IC DESIGN (Professional Elective-V)	Course Code V20ECT25	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1: Analyze the concepts of MOS Design. **[K2]**
CO2: Design and analysis of Combinational MOS Circuits. **[K2]**
CO3: Design and analysis of Sequential MOS Circuits. **[K2]**
CO4: Construct Dynamic Logic Circuits Using Various Logic Styles. **[K2]**
CO5: Describe the Concepts of Semiconductor Memories, Flash Memory, RAM array organization **[K2]**

UNIT-I

MOS Design:

Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II

Combinational MOS Logic Circuits:

MOS logic circuits with NMOS loads, Primitive CMOS logic gates NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

UNIT-III

Sequential MOS Logic Circuits:

Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT-IV

Dynamic Logic Circuits:

Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

UNIT-V

Semiconductor Memories:

Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory, NOR flash and NAND flash.

TEXT BOOKS:

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
2. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Ed., PHI.

Job Oriented Elective Courses

(V20 Regulation)

Sem.	FPGA Architecture (Job Oriented Elective)	Course Code: V20ECTJOC01	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1 Describe Low end programmable devices and FPGA basics. **[K2]**
CO-2 Describe Spartan 6 basics. **[K2]**
CO-3 Use Virtex 5 clock sources and FIFO. Comprehend various I/O standards. **[K3]**
CO-4 Use Memory, DSP blocks in complex designs. Comprehend SerDes. **[K3]**
CO-5 Distinguish RISC based Soft processors from Xilinx, Aletra. **[K3]**

UNIT-I
DESIGNING WITH PROGRAMMABLE LOGIC DEVICES:
Read only Memories, Programmable logic Arrays (PLA), Programmable Array logic (PAL), Programmable logic Devices (PLD). Skew, setup, hold time.
DESIGNING WITH FPGA:
Logic implementation options, Technology trends, Simple SRAM programmable FPGA architecture, Xilinx 3000 series FPGAs, Programmable interconnects, Xilinx 4000 series FPGAs, Programming the FPGA.

UNIT-II
SPARTAN 6 ARCHITECUTUTE:
Spartan 6 Device features- 6 input LUT, Slice, Single Port RAM, Dual Port RAM, ROM, Distributed RAM, 32 x 6, 64 x 1, 128 x 1, Distributed RAM timings, Shift Registers, Multiplexers, Interconnect, PLL, DCM, DSP Slice.

UNIT-III
VIRTEX 5 ARCHITECTURE:
Clock resources-Global clocks, regional clocks, Clock buffer, Clock Gating. Clock Tree, Clock De-skew, True Dual port RAM. Write modes, FIFO architecture, empty flags, almost empty flags, almost fill flags, full flag, cascading FIFOS, connecting FIFOs in parallel, designing Large multiplexer 4xl, 8xl, 16xl. Control impedance, I/O primitives. I/O supported standards, LVDS.

UNIT-IV
STARATIX V ARCHITECTURE:
ALM Block diagram, ALM operating modes, ALM in Arithmetic mode, Types of embedded memory, Control clocking, Memory features, Memory modes, DSP block features, operational modes, DSP block architecture in 27 X 27 mode, independent complex multiplier mode, I/O features mixing voltage referenced and non voltage referenced standard I/O features standards. Dynamic OCT.LVDS Serdes block diagram and features, Differential Receiver Block diagram and features.

UNIT-V
SOFT PROCESSORS:
JTAG, programming through JTAG, IEEE 1149.1 Boundary scan testing, programmable power technology, Feratures of Soft processors, Nios-II, Microblaze.

TEXT BOOKS:

1. Charles H Roth **J**r– Digital System Design using VHDL‖, second edition, 2008.
2. Spartan 6 family overview.
3. Virtex 5- User Guide.

REFERENCES:

1. **J**. Old Field,R.Dorf, -Field Programmable Gate Arrays‖, **J**ohn Wiley & Sons, New York, 1995.
2. S. Trimberger, Edr.-Field Programmable Gate Arrays Technology‖, Kluwer Academic Publications, 1994.
3. Bob Zeidman, – Designing with FPGAs & CPLDs‖, CMP Books, 2002.

Sem.	Optical Communication & Networks (Job Oriented Elective)	Course Code: V20ECTJOC02	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:
CO1. Describe the overview of optical fiber communication, ray theory transmission and concepts of modes. **[K2]**
CO2. Explain the Transmission characteristics of fiber and optical fiber Connectors. **[K2]**
CO3. Describe the operation of optical sources, photo detectors and optical Receiver. **[K2]**
CO4. Explain WDM Concepts and Components. **[K2]**
CO5. Explain the Optical switching networks. **[K2]**

UNIT I
Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber wave guides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cut-off wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers.**(Text 2)**

UNIT II
Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.
Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices: Fusion Splices, Mechanical splices, Fiber connectors: Cylindrical ferrule connectors, Duplex and Multiple fiber connectors, Fiber couplers: three and four port couplers, star couplers, Optical Isolators and Circulators**.(Text 2)**

UNIT III
Optical sources: Light emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant Frequencies.
Photodetectors: Physical principles of Photodiodes, Photo detector noise, Detector responsetime.
Optical Receiver: Optical Receiver Operation: Error sources, Front End Amplifiers,Receiver sensitivity, Quantum Limit.**(Text1)**

UNIT IV
WDM Concepts and Components: Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer, Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings. Introduction to Optical amplifiers: Basic application and Types. **(Text 1)**

UNIT V
Optical Networks: Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment,

Optical switching networks: Optical circuit switched networks, packet switched networks,Multiprotocol Label Switching, Optical burst switching networks.**(Text 2)**

TEXT BOOKS:
1. Optical Fiber Communications – Gerd Keiser, McGraw-Hill International edition, 5th Edition, 2015.
2. Optical Fiber Communications – John M. Senior, PHI, 3rd Edition, 2010.

RERFERENCES:
1. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
2. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.

Sem.	Industrial IoT (Job Oriented Elective)	Course Code: V20ECTJOC03	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe the key techniques and theory behind Industrial Internet of Things **[K2]**
CO2: Explain the key techniques and theory behind Industrial Internet of Things **[K2]**
CO3: Explain the integration of Cloud and IoT, Edge and Fog Computing **[K2]**
CO4: Apply effectively the various enabling technologies (both hardware and software) for IIoT **[K3]**
CO5: Illustrate and build IIoT system for different Use cases **[K3]**

Unit – I – Introduction to IoT

Overview of Internet of Things, Introduction, IoT Architecture, Application-based IoT Protocols - Infrastructure-based protocols, Data protocols, Transport protocols; Cloud Computing - Types of cloud, Business aspects of cloud, Virtualization: Key aspect of cloud computing, Mobile cloud computing; Fog Computing - Applications of Fog computing; Sensor Cloud - Applications of Sensor Cloud; Big Data.

Unit -II - Introduction to IIoT

Industry 4.0, Introduction IIoT, Design requirement of Industry 4.0, Drivers of Industry 4.0, Sustainability Assessment of Industry, Smart Business perspective, Cybersecurity, Impacts of Industry 4.0, Industrial Internet Systems, Industrial Sensing, Industrial Process.

Unit – III- IoT Technologies

Business Model of IIoT, Reference Architecture of IIoT, Off-site Technologies – cloud computing & Fog Computing, On-site Technologies –Augmented Reality, Virtual Reality, Big Data & Advance Analytics, Smart factories.

Unit -IV Sensors, Actuators & Data Transmission

Sensors – Thermal, Mechanical, Electrical, optical; Actuators – Thermal, Hydraulic, Electromechanical; Industrial Data Transmission – Profibus, Modbus, CAN, NB-IoT, IEEE 802.11AH.

Unit – V Case Studies

Introduction, Manufacturing Industry; Automotive Industry; Mining Industry.

Textbooks:

1. SudipMisra, Chandana Roy, Anandarup Mukherjee, -Introduction to Industrial Internet of Things and Industry 4.0‖.
2. Alasdair Gilchrist, -Industry 4.0: The Industrial Internet of Things‖.

References:

1. Antonio Capasso, GiacomoVeneri, "Hands-On Industrial Internet of Things", Packt Publishing.
2. Chen, Fulong, Luo, Yonglong, -Industrial IoT Technologies and Applications‖, LNICST Series.

Sem.	Modern Satellite Communication (Job Oriented Elective)	Course Code V20ECTJOC04	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1: Describe the basic concepts and orbit mechanics of satellite communication.

[K2]CO2: Discuss the major subsystems of a satellite and satellite link design. **[K2]**

CO3: Describe the various sub-systems used in Earth stations and the different orbits.

[K2]CO4: Illustrate the various multiple access techniques. **[K2]**

CO5: Explain the Special purpose communication satellites and Global Positioning System. **[K2]**

UNIT I

INTRODUCTION: Origin of Satellite Communications, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

ORBITAL MECHANICS: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbital effects in communication systems performance. Advanced payload systems and launch vehicles.

UNIT II

SATELLITE SUB SYSTEMS: Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna.

SATELLITE LINK DESIGN: General Link equation, system noise temperature and G/T ratio,Design of down links, up link design.

UNIT III

EARTH STATION TECHNOLOGY: Introduction, Transmitters, Receivers, Antennas, Tracking systems, advanced ground sub systems.

LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS: Orbit consideration, coverage and frequency considerations, Delay & Through put considerations, System considerations. Very high throughput satellites, Operational NGSO constellation Designs.

UNIT IV

Frequency division multiple access (FDMA), Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure. Satellite Switched TDMA Onboard processing, Code Division Multiple access (CDMA),Spread spectrum transmission and reception.

UNIT V

Special Purpose Satellites: Earth observation satellite,Satellite Television,Direct Broadcast Satellite-TV receiver, Very Small Aperture Terminal(VSAT),Mobile Communication Satellite system(MSAT), Search and Rescue satellites(SARSAT),GPS Systems, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, Differential GPS. Satellite Internet of Things.

TEXT BOOKS:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.

REFERENCES:

1. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
2. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004

Sem.	Wireless Sensors And Networks (Job Oriented Elective)	Course Code: V20ECTJOC05	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Explain the concepts of Wireless Sensor Networks, it's Architecture. **[K2]**

CO2: Describe the Networking Technologies. **[K2]**

CO3: Explain the MAC Protocols. **[K2]**

CO4: Illustrate the Routing and Transport Layer Protocols. **[K2]**

CO5: Explain the Security Layer Protocols and Applications of WSN. **[K2]**

UNIT I - Overview of Wireless Sensor Networks:
Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints and challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, OperatingSystems and Execution Environments, Network Architecture -Sensor Network Scenarios, Gateway Concepts.

UNIT II - Networking Technologies:
Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hiddennode and exposed node problem, Topologies of PANs, MANETs, WANETs.

UNIT-III - MAC Protocols for Wireless Sensor Networks:
Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols - Contention - Based Protocols, with reservation Mechanisms, and with Scheduling Mechanisms.

UNIT-IV–Routing and Transport Layer Protocols:
Routing Protocols:, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks,Classification of Routing Protocols, Table–Driven Routing Protocols, On – Demand Routing Protocols.
Transport Layer Protocols: Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks.

UNIT- V - Security, Platforms & Applications:
Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning; Sensor Node Hardware – Berkeley Motes, Programming Challenges; Applications - Home Automation, Smart Metering.

TEXT BOOKS:

1. Ad Hoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Adhoc and Sensor Networks: Protocols, Performance and Control, JagannathanSarangapani, CRC Press.
3. Holger Karl & Andreas Willig, -Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

REFERENCES:

1. Wireless Sensor Networks- Technology, Protocols, and Applications, KazemSohraby, Daniel Minoli, &TaiebZnati, John Wiley, 2007.
2. Wireless Sensor Networks- An Information Processing Approach,Feng Zhao & Leonidas J. Guibas, Elsevier, 2007.
3. Adhoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh,1st Ed., PearsonEducation.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.
5. Wireless Sensor Networks – S Anandamurugan, Lakshmi Publications.

Sem.	Digital Signal Processors and Applications (Job Oriented Elective)	Course Code: V20ECTJOC06	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Describe the concepts of digital signal processing. **(K2)**
CO-2: Explain architectures used in programmable DSP's.**(K2)**
CO-3: Illustrate addressing modes and memory organization of TMS32OC54xx processor**. (K3)**
CO-4: Describe the Instruction set, peripheral devices and programming techniques**. (K2)**
CO-5: Illustrate the applications of DSP processor (**K3)**

UNIT I
INTRODUCTION TO DIGITAL SIGNAL PROCESSING:
A Digital Signal Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation, Number Formats for Signals and coefficients in DSP Systems.

UNIT II
ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS:
Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

UNIT III
PROGRAMMABLE DIGITAL SIGNAL PROCESSORS:
Commercial digital Signal-processing Devices, Data Addressing Modes of TMS32OC54xx, Memory Space of TMS32OC54xx Processors, Program Control.

UNIT IV
INSTRUCTION SET AND PROGRAMMING: TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts, Pipeline Operation of TMS32OC54xx Processor.

UNIT V
INTERFACING AND APPLICATIONS OF DSP PROCESSOR:
Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

TEXT BOOKS:

1. Digital Signal Processing, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.
2. Digital Signal Processing, Principles, Algorithms, and Applications by John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
3. Discrete Time Signal Processing by A.V.Oppenheim and R.W. Schaffer, PHI

Reference Books:

1. Digital Signal Processing by Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing by MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.

Sem.	Modern Wireless Communication Systems (Job Oriented Elective)	Course Code: V20ECTJOC07	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe how to measure the performance of wireless system, in multipath Environment **[K2]**

CO2: Summarize about Wireless Channel. **[K2]**

CO3: Explain Principle and properties of CDMA. **[K2]**

CO4: Discuss the working and advantages of MIMO wireless communication systems **[K2]**

CO5: Explain the principle and advantages of OFDM system and various modern wireless communication technologies **[K2]**

Unit I: Introduction to Wireless Systems: Evolution of Wireless Communication Technologies, Modeling Wireless Channel, Wireless Fading Channel Model, Fading Channel Distribution , Rayleigh Fading Channel, Bit Error Rate (BER) Performance, Bit Error Rate (BER) of AWGN Channels.

Unit II: Performance in Fading wireless channels: Bit Error Rate of Rayleigh Fading Wireless Channel, Exact BER Expression for Rayleigh Fading Wireless Channel, Deep Fade Analysis of Wireless Communication, Principle of Diversity, Multiple Antenna Diversity, BER of Multiple Antenna Wireless Systems.

Wireless Channel Characterization : Delay Spread and Doppler,RMS Delay Spread, Delay Spread and Inter Symbol Interference, Coherence Bandwidth of Wireless Channel,Impact of Doppler Effect on Wireless Channel

Unit III: Principles of CDMA Wireless Communication: Introduction to Code Division Multiple Access (CDMA),Chip Time and Bandwidth Expansion in CDMA, Code Generation for CDMA,CDMA Codes: Properties of PN Sequences, BER of CDMA Systems

Unit IV: Principles of CDMA and MIMO Wireless Communication: Analysis of Multi-user CDMA, Multipath Diversity in CDMA Systems, Near-Far Problem in CDMA, Multiple Input Multiple Output (MIMO) Systems, Examples of MIMO Systems, MIMO Receivers, BER Performance of ZF Receiver, Alamouti Code and Space-Time Block Codes, BER of Alamouti Coded System, Singular Value Decomposition (SVD), SVD in MIMO

Unit V: Principles of OFDM Wireless Communication: Capacity of MIMO Wireless Systems, SVD based MIMO Transmission, Orthogonal Frequency Division Multiplexing (OFDM), Transmission in Multicarrier Systems, FFT/IFFT Processing in OFDM, Cyclic Prefix in OFDM Systems, Schematic Representation of OFDM Transmitter and Receiver, BER Performance of OFDM Systems.

Text Books:

1. Aditya K. Jagannatham, ―Principle of Modern Wireless Communication Systems: Theory and practice‖ 1st Edition, McGrawHill Publication

2. Theodore S. Rappaport, ―Wireless Communications: Principles and Practice‖ Second Edition, Pearson Education

Reference Books:

1. Simon Haykin, MichaleMoher, ―Modern Wireless Communications‖, Pearson.

2. Xiaodong Wang, H. Vincent Poor, ―Wireless Communication Systems: Advanced Techniques for Signal Reception.

Sem.	CMOS Analog IC Design (Job Oriented Elective)	Course Code: V20ECTJOC08	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Describe the concept of MOS device and modeling of MOS drain current for large and small signal analysis **(K2)**
CO-2: Design and analyze Analog CMOS Sub-Circuits **(K4)**
CO-3: Describe the large signal and small signal analysis of Inverters & differential amplifier **(K2)**
CO-4: Describe the large signal and small signal analysis of cascade amplifier & Current Amplifiers **(K2)**
CO-5: Illustrate the CMOS output Amplifiers **(K3)**

UNIT -I: MOS Devices and Modeling: The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT -II: Analog CMOS Sub-Circuits: MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors Cascade current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT -III: CMOS Amplifiers-I: Inverters- Active load inverter, current source inverter, push-pull inverter, Differential Amplifiers- large signal analysis, small signal analysis, design of differential amplifier,

UNIT -IV: CMOS Amplifiers-II: Cascode Amplifiers- Large signal analysis, small signal analysis and frequency response, design of cascade amplifier, Current Amplifiers- single ended input current amplifier, differential input current amplifier,

UNIT-V: Output Amplifiers: class-a amplifier, source follower, push pull CS amplifier, High Gain Amplifiers Architectures.

TEXT BOOKS:

1. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition.

REFERENCE BOOKS:

1. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2016.
2. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewisand R. G. Meyer, Wiley India, Fifth Edition, 2010.
3. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce, PHI

Sem.	Bio Medical Instrumentation (Job Oriented Elective)	Course Code: V20ECTJOC09	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Explain the basics concepts of Bio-Medical Instrumentation **(K2)**
CO2: Explain the concepts of electrode theory, classification of Electrodes and Transducers used in Bio-Medical Applications **(K2)**
CO3: Explain the Anatomy and Physiology of Cardiovascular system and Illustrate the application of Bio-Medical Instruments to measure the Physiological parameters of Cardiovascular System **(K2)**
CO4: Discuss the processing methods in elements used for Patient's Health care & monitoring.
CO5: Classify different types of monitors, discuss the principals of recorders and Illustrate the methods of accident preventions i.e. Shock Hazards from different Electrical Equipment. **(K2)**

UNIT-I:

INTRODUCTION TO BIOMEDICAL INSTRUMENTATION: Age of Biomedical Engineering, Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Muscle, Bioelectric Potentials, Sources of Bioelectric Potentials, Resting and Action Potentials, Bio electric Potentials- ECG,EEG and EMG, Envoked Responses.

UNIT-II:

ELECTRODES AND TRANSDUCERS: Introduction, Electrode Theory, Bio potential Electrodes, Examples of Electrodes, Basic Transducer Principles ,The Transducer and Transduction Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Pulse Sensors, Respiration Sensor, Transducers with Digital Output.

UNIT-III:

CARDIOVASCULAR SYSTEM AND MEASUREMENTS: The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart Sounds, Plethysmography.
MEASUREMENTS IN THE RESPIRATORYSYSTEM: The Physiology of The Respiratory System, Tests and Instrumentation for the Mechanics of Breathing, Respiratory Therapy Equipment.

UNIT-IV:

PATIENT CARE AND MONITORING: Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient-Monitoring Equipment, Other Instrumentation for Monitoring Patients, Organization of the Hospital for Patient-Care Monitoring, Pacemakers, Defibrillators.

UNIT-V:

MONITORS, RECORDERS AND SHOCK HAZARDS: Bio potential Amplifiers, Monitors, Recorders, Shock Hazards and Prevention, Physiological Effects and Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Isolated Power Distribution System.

Text Books:

1.–Bio-Medical Electronics and Instrumentation‖, Onkar N. Pandey, Rakesh Kumar, Katson Books.
2.–Bio-Medical Instrumentation‖, Cromewell, Wiebell, Pfeiffer

References:

1. –Hand Book of Bio-Medical Instrumentation‖, Khandapur. McGrawHill
2. –Introduction to Bio-Medical Equipment Technology‖, 4th Edition, Joseph J.Carr, John M.Brown, Pearson Publications.

Sem.	SPEECH SIGNAL PROCESSING (Job Oriented Elective)	Course Code: V20ECTJOC10	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO 1 Outline the basic characteristics of speech signal in relation to speech production and model the speech production system.(**K2)**
CO 2 List different speech parameters. **(K2)**
CO 3 Apply various algorithms for speech enhancement and speech coding. **(K3)**
CO 4 Design a simple system for speech recognition. **(K3)**
CO 5 Make use of different Speaker Recognition Techniques. **(K3)**

UNIT I

Speech Production: Speech signal; Speech Production process: Lungs, Larynx and Vocal folds, Vocal tract; Acoustic Phonetics: Vowels, Diphthongs, Semi vowels, Nasals, Unvoiced fricatives, Voiced fricatives, Voiced and unvoiced stops; Acoustic theory of speech production; Digital models for speech signals.

UNIT II

Speech Analysis: Time-Dependent processing of speech; Short-Time energy and average magnitude; Speech vs. Silence discrimination using energy and zero crossings; Short-Time autocorrelation; Short-Time average magnitude difference function; Pitch period estimation using autocorrelation function; Linear Predictive Coding (LPC) Analysis; Cepstral Analysis.

UNIT III

Speech Enhancement: Nature of Interfering Sounds; Speech Enhancement (SE) Techniques: Basic principles of Spectral Subtraction; Wiener Filtering; Wiener filtering for noise reduction; Statistical-Model-based method: Maximum-likelihood estimator for speech enhancement; Applications of speech enhancement.

UNIT IV

Speech Coding: Quantization; Speech redundancies; Time-Domain waveform coding: Basic Time-Adaptive Waveform Coding, Exploiting Properties of the Spectral Envelope; Linear predictive coding (LPC)-based coders: Adaptive delta modulation, Adaptive differential pulse code modulation, Code-excited linear prediction.

UNIT V

Automatic Speech and Speaker Recognition: Introduction: ASR Search, Variability in Speech Signals, Speech recognition approaches - using HMMs and Deep Neural Networks, Speaker recognition using GMMs, I-Vector and Deep Learning

Text books:

1. Douglas O Shaughnessy, -Speech Communications Human and Machine‖ 2 nd Edition, IEEE Press, 2000.
2. Dr Shaila D Apte, – Speech and Audio Processing , Wiley India, 1ST Edition 2012

Reference Books:

1. Philipos C. Loizou, -Speech Enhancement‖ 2 ndEdition, CRC Press, Taylor & Francis Group, 2013
2. Thomas F. Quatieri, -Discrete -Time Speech Signal Processing: Principles and Practice‖, Pearson Education, 2002

Sem.	Electronic Instrumentation (Job Oriented Elective)	Course Code: V20ECTJOC11	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1. Select the instrument to be used based on the requirements.**[K2] CO2.** Understand the design of oscilloscopes for different applications.**[K2]CO3.** Explain different signal generators and analyzers.**[K2]**

CO4. Understand the design of different types of Bridge circuits for different Applications.**[K2]**

CO5. Explain and Design different types of transducers for different Applications and for measurement of Physical Parameters.**[K2]**

UNIT-I

Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error. DC Voltmeters-Multi-range, Range extension/Solid state and differential voltmeters, AC voltmeters-multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, and shunt type, Multi-meter for Voltage, Current and resistance measurements.

UNIT-II

Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement.

UNIT-III

Signal Generator- fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Arbitrary waveform. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.

UNIT-IV

DC Bridges: Measurement of Resistance-Wheatstone's Bridge, Kelvin's Bridge. AC Bridges: Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson Bridge. Measurement of capacitance-Schering's Bridge. Measurement of Frequency-Wien Bridge, Errors and precautions in using bridges.

UNIT-V

Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors. Measurement of physical parameters- Force, Pressure, Velocity, Humidity, Moisture. Data acquisition systems.

TEXTBOOKS:

1. Electronic Instrumentation, second edition -. S. Kalsi, Tata Mc Graw Hill, 2004.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrickand W.D.Cooper, PHI, 5th Edition, 2002.

REFERENCES:

1. Electronic Instrumentation & Measurements- David A. Bell, PHI, 2nd Edition, 2003.
2. Electronic Test Instruments, Analog and Digital Measurements- Robert A. Witte, Pearson Education, 2ndEdition, 2004.
3. ElectronicMeasurements & Instrumentations by K. Lal Kishore, Pearson Education-2005.
4. Electronic Measurements & Instrumentation by Uday A.Bakshi & Ajay V. Bakshi Technical Publications.

Sem.	Sensors & Applications (Job Oriented Elective)	Course Code: V20ECTJOC12	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe the sensors and theory behind **[K2]**
CO2: Explain the Sensors used in mechanical systems. **[K2]**
CO3: Explain the Thermal and electrical Sensors **[K2]**
CO4: Explain the Magnetic, Acoustic and High frequency sensors **[K2]**
CO5: Illustrate and build IoT or IIoT systems for different Use cases **[K3]**

UNIT – I

Introduction: transducer, Electrical sensor – need for sensors in the modern world. Different fields of sensors based on the stimuli - various schematics for active and passive sensors.General characteristics and specifications of sensors - Implications of specifications uses of sensors - measurement of stimuli - block diagram of sensor system. Brief description of each block.

UNIT– II

Sensors for mechanical systems or mechanical sensors - Displacement - acceleration and force - flow of fluids - level indicators - pressure in fluids - stress in solids. Typical sensors - wire and film strain gauges, anemometers, piezo electric, accelerometers, potentiometric sensors, LVDT.

UNIT– III

Thermal sensors – temperature – temperature difference – heat quantity. Thermometers for different situation – thermocouples thermistors – colorpyrometry.Optical sensors: light intensity – wavelength and color – light dependent resistors, photodiode, photo transistor, CCD, CMOS sensors.

Electrical sensors: conventional volt and ammeters, high current sensors, (current transformers), high voltage sensors, High power sensors.

UNIT – IV

Magnetic sensors: magnetic field, magnetic flux density – magneto resistors, Hall sensors, super conduction squids.

Acoustic or sonic sensors: Intensity of sound, frequency of sound in various media, various forms of microphones, piezo electric sensors.

High frequency sensors like microwave frequency sensors, wavelength measuring sensors. MEMs and MEM based sensors.

UNIT – V

Applications in IoT: Smart Cities and AgricultureApplications in IIoT: Manufacturing and Automotive Industries.

Textbooks:

1. Henry Bolte, -Sensors – A Comprehensive Sensors‖, John Wiley
2. Doebelin, -Measurement Systems: Application and Design‖, McGraw Hill.

References:

1. Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim -Microsensors, MEMS and Smart Devices‖, New York: Wiley
2. KouroshKalantar – Zadeh, Benjamin Fry, -Nanotechnology- Enabled Sensors‖, Springer
3. Ramon Pallas-Areny, John G. Webster, -Sensors and signal conditioning‖ John Wiley & Sons.

Sem.	Deep Learning (Job Oriented Elective)	Course Code: V20ECTJOC13	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Describe the basics of learning algorithms. **(K2)**
CO2: Explain neural network and various parameters while training neural network. **(K2)**
CO3: Describe convolution neural network and its training. **(K2)**
CO4: Discuss various advanced neural network architectures. **(K2)**
CO5: Discuss various Deep Learning applications. **(K2)**

Unit-I
Introduction:
Introduction to Deep Learning, Bayesian Learning, Optimization Techniques, Gradient Descent, Batch Optimization. Bias and Variance, Maximum Likelihood Estimation,Supervised Learning Algorithms, Unsupervised Learning Algorithms.

Unit-II
Neural Networks:
The Basic Architecture of Neural Networks- Single Computational Layer: The Perceptron, Multilayer Neural Networks; Training a Neural Network with Backpropagation, Practical Issues in Neural Network Training-The Problem of Overfitting, The Vanishing and Exploding Gradient Problems, Unsupervised Learning with Deep Network, Autoencoders.

Unit-III
Convolution neural network and training:
Introduction, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, The ReLU Layer, Pooling, Fully Connected Layers, The Interleaving Between Layers, , Transfer Learning
Gradient Descent, Momentum Optimizer, RMSProp, Adam , Transfer Learning ,Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization

Unit-IV
Advanced Deep Learning Architectures:
Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN , LSTM Networks, Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network.

Unit-V
Deep Learning applications:
Applications of Convolutional Networks: Content-Based Image Retrieval, Object Localization, Object Detection, Natural Language and Sequence Learning; Application of Recurrent Neural Networks: Application to Automatic Image Captioning, Time-Series Forecasting and Prediction, End-to-End Speech Recognition, Handwriting Recognition.

Text Books
1. -Deep Learning‖, Ian Goodfellow, Yoshua Bengio, Aaron Courville, The MIT Press, 2016.
2. ‖Neural Networks and Deep Learning‖,Charu C. AggarwalSpringer.

Reference Books
1. Raúl Rojas ‖ Neural Networks: A Systematic Introduction,,Springer.
2.Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

Sem.	Machine Learning (Job Oriented Elective)	Course Code: V20ECTJOC14	L	T	P	C
			3	0	0	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Explain the principles and concepts of machine learning **(K2)**
CO2: Describe the different machine learning approaches and techniques **(K2)**
CO3: Explain the clustering techniques used in Data representation. **(K2)**
CO4: Explain the neural network concepts **(K2)**
CO5: Describe the regression and reinforcement learning and solve ML problems using Machine learning tools **(K2)**

UNIT I

Introduction: Machine learning: What and why? , Types of Machine Learning Supervised Learning ,Unsupervised Learning , The Curse of dimensionality, Over and under fitting , Model selection , Error analysis and validation , Parametric vs. non,parametric models.

UNIT II

Machine learning: Types of Machine Learning , Supervised Learning, Classification models , Naïve Bayes Classifier , Decision trees , Support Vector Machines , KNN model , Dimensionality reduction , PCA.

UNIT III

Clustering: Clustering approaches , Mean Shift clustering , Clustering data points and features ,Bi-clustering , Multi,view clustering , K-Means clustering , K-medians clustering , Expectation Maximization (EM).

UNIT IV

Neural Networks: Neural networks , Biological motivation for Neural Network, Neural network Representation , Perceptron , Feed forward networks , Multilayer Networks and Back Propagation Algorithms , Hidden layer representation , Application of neural network.

UNIT V

Applications and Tools: Linear models for regression , Reinforcement Learning , Machine Learning Tools , Engineering applications.

Text Books:

1. Kevin P. Murphy, -Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012.
2. Ethem Alpaydin, -Introduction to Machine Learning‖, Second Edition, Prentice Hall of India, 2010.

Reference Books:

1. Laurene Fausett, -Fundamentals of Neural Networks, Architectures, Algorithms and Applications‖, Pearson Education, 2008.
2. Tom Mitchell, -Machine Learning‖, McGraw,Hill, 1997.

The institution is offering Honors degree in ECE and Minors degree in ECE (VLSI & ES) under V20 regulation.

CURRICULAR FRAMEWORK FOR HONORS DEGREE PROGRAMME

i. B. Tech. (Hons.) is introduced in order to facilitate the students to choose additionally the specialized courses and build their competence in a specialized area.

ii. Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

iii. A student shall be permitted to register for Honors program at the beginning of V semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 CGPA up to the end of III semester without any history of backlogs. An CGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Honors registration active.

iv. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

v. In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160/121 credits).

vi. 20 credits shall be earned by undergoing specified courses listed as pools. The credits must be acquired by studying either in MOOCs courses under Swayam platform or conventional type will be decided by the college at the time of registration for Honors degree.

vii. MOOCs courses shall be domain specific with a minimum duration of 8/12 weeks as recommended by the Head of the department concerned.

viii. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

ix. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the academic council.

x. The concerned BOS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

xi. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a **"pass (P)"** grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xii. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii. Switching from honors degree to minor degree is not permitted.

xiv. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned Bachelor'sDegree.

Course Structure for Honors Degree in ECE:

S. No	Name of the Course	Credits
1	NPTEL online course of Relevance (8/ 12 weeks)	3
2	NPTEL online course of Relevance (8/ 12 weeks)	3
3	NPTEL online course of Relevance (8/ 12 weeks)	3
4	NPTEL online course of Relevance (8/ 12 weeks)	3
5	NPTEL online course of Relevance (8/ 12 weeks)	3
6	NPTEL online course of Relevance (8/ 12 weeks)	3
7	Mini Project	2
	Total Credits	**20**

Honors (For ECE) Students:

Track-I: Communication & Signal Processing

1. Modern Digital Communication Techniques
2. Communication for 5G and Beyond
3. Modern CDMA/ MIMO/ OFDM Wireless Communications
4. Signal Processing Techniques And Its Applications
5. Broadband Networks: Concepts And Technology
6. Bio medical Image Processing
7. Cognitive Radio

Track-II: VLSI & Embedded Systems

1. Analog & Mixed Signal ICs
2. ASIC Design
3. C- Based VLSI Design
4. Fabrication Techniques for MEMS Based Sensors
5. Embedded System Design with ARM
6. MEMS & Micro Systems
7. EMC in Design

NOTE:

List of Courses will be updated in every semester as per the courses offered byNPTEL.

CURRICULAR FRAMEWORK FOR MINOR DEGREE PROGRAMME:

i. a) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects courses from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

ii. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

iii. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

iv. There shall be no limit on the number of programs offered under Minor. The Institute can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

vi. A student shall be permitted to register for Minors program at the beginning of V semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 7.75 CGPA up to the end of III semester without any history of backlogs. An CGPA of 7.75 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

v. A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160/121 credits).

vi. 20 credits shall be earned by undergoing specified courses listed as pools. The credits must be acquired by studying either in MOOCs courses under Swayam platform or conventional type will be decided by the college at the time of registration for Honors degree.

vii. MOOCs courses shall be domain specific with a minimum duration of 8/12 weeks as recommended by the Head of the department concerned.

viii. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domainspecific courses and advanced courses.

ix. MOOCs courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the academic council.

x. Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

xi. A committee shall be formed at the level of College/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

xii. If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a **"pass (P)"** grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xiii. In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiv. Switching from minor degree to honor degree is not permitted. Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned Bachelor's Degree.

Course Structure for Minors in ECE (VLSI & ES) Degree for all other BranchStudents

S. No	Name of the Course	Mode of Learning	No. of Weeks	Credits
1	Introduction to Semi Conductor Devices	NPTEL	12 weeks	3
2	Semiconductor Devices and Circuits	NPTEL	12 weeks	3
3	Digital Circuits	NPTEL	12 weeks	3
4	Digital IC Design	Conventional Teaching	8 weeks	2
5	Basics of VLSI Design	Conventional Teaching	12 weeks	3
6	System design through Verilog	NPTEL	8 weeks	2
7	CMOS Analog VLSI Design	Conventional Teaching	12 weeks	3
8	Introduction to Internet of Things	NPTEL	12 weeks	3
9	Microprocessors & Micro Controllers	NPTEL	8 weeks	2
10	Concepts of Embedded Systems	Conventional Teaching	8 weeks	2
11	Embedded system Design with ARM	NPTEL	8 weeks	2
12	Project work		16 weeks	4

Note:

While registering for the course, the students have to take the approval from thedepartment.

Above list of courses is tentative.

Total Credits: 20 (16 Credits from the above list of courses + 4 Credits from Project work)

Open Elective Courses

(V20 Regulation)

Sem.	Internet of Things (Open Elective)	Course Code: V20ECTOE01	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Describe M2M and IOT Technologies. **(K2)**

CO-2: Identify the layers and protocols in IOT. **(K2)**

CO-3: Describe various communication technologies used in IOT**. (K2)**

CO-4: Demonstrate various hardware components required for IOT applications. **(K2)**

CO-5: Identify the cloud technologies & explain the applications of IoT**. (K2**)

UNIT I – INTRODUCTION

Introduction from M2M to IoT - An Architectural Overview, building architecture, Main design principles and needed capabilities, An IoT architecture outline, M2M and IoT Technology Fundamentals - Devices and gateways

UNIT II – IOT PROTOCOLS

Functionality of Layers in IoT –Study of protocols - Wireless HART, Z-Wave, 6LoWPAN, RPL, CoAP, MQTT.

UNIT III - COMMUNICATION TECHNOLOGIES IN IOT

IoT Connectivity – IEEE 802.15.4, Wi-Fi, Bluetooth, Zigbee, LPWAN, 5G Era.

UNIT IV - SYSTEM HARDWARE

Sensors, Actuators, Radio Frequency Identification, Introduction to Embedded Devices for IoT - RASPBERRY PI.

UNIT V – Cloud Computing & Case Studies

Data Collection, Storage and Computing Using a Cloud Platform for IoT Applications/Services. Real-time applications of IoT - Smart and Connected Cities, Agriculture.

TEXTBOOKS:

1. -From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖ Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle , 1st Edition, Academic Press, 2014.
2. IOT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Cisco Press 800 East 96th Street Indianapolis, USA.
3. -Internet of Things (A Hands-on- Approach)‖, Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2014.
4.

REFERENCE BOOKS:

1. From Internet of Things to Smart Cities: Enabling Technologies - edited by Hongjian Sun, Chao Wang, Bashar I. Ahmad, CRC Press -2018.
2. -Architecting the Internet of Things‖, Bernd Scholz-Reiter, Florian Michahelles, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
3. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT, David Etter.

Sem.	Communication Systems (Open Elective)	Course Code: V20ECTOE02	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Demonstrate the fundamentals of communication systems **(K2)**
CO-2: Compare the various analog modulation and demodulation schemes **(K2)**
CO-3: Compare the various digital modulation and demodulation schemes **(K2)**
CO-4: Explain the wireless communication system concepts **(K2)**
CO-5: Outline the satellite & Optical communication system principles **(K2)**

Unit-I

Fundamentals of Communication systems: Block diagram of communication system; types of communications-analog and digital; Noise–types of noise, sources of noise, and noise figure.

Unit-II

Fundamentals of Analog Communication: Need for modulation; Types of analog modulation techniques (AM, FM & PM). Sampling theorem, Nyquist criteria, introduction to PAM, PWM and PPM.

Unit-III

Fundamentals of Digital Communication: Advantages; Working principle of PCM; introduction to digital modulation techniques-ASK, FSK, &PSK.

UNIT-IV:

Fundamentals of Wireless Communication: Evolution of mobile communications, Mobile Radio System around the world, Comparison of Common wireless system, Concepts of 1G, 2G, 3G, 4G. , Introduction to 5G.

Unit-V

Fundamentals of Satellite & Optical communication: Brief history of Satellite systems; Principles, architecture. Fundamentals of Optical Communication: Evolution of fiber optic system, Elements of an Optical Fiber Transmission link and Reception link.

Textbooks:

1. Principles of Communications by H. Taub and D. Schilling, TMH, 2003.
2. Wireless Networks: Applications and Protocols by T. S. Rappaport, Pearson Education
3. Satellite Communications by Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
4. Optical Fiber Communication by Gerd Kaiser (TMH)

References:

1. Electronic Communication Systems by Kennedy and Davis, TMH, 4th edition, 2004.
2. Wireless Communication and Networks: 3G and Beyond by I. SahaMisra, TMH Education.
3. Satellite Communications: Design Principles by M. Richharia, B S publications, 2nd Edition, 2003.

Sem.	Principles of Image Processing (Open Elective)	Course Code: V20ECTOE03	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1. Understand the different Transforms Techniques & their use in Image Processing Applications. **(K2)**
CO2. Describe Spatial and frequency domain filtering like smoothing and sharpeningoperations on Images. **(K2)**
CO3. Describe Restoration operations/techniques on Images. **(K2)**
CO4. Describe the Image compression Techniques and Image segmentation.
(K2)CO5. Explain the different color Image Processing Techniques. **(K2)**

UNIT-I- Introduction
Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.
Image Transforms: Discrete Fourier transform (DFT) and Discrete Cosine transform.

UNIT-II- Image Enhancement Techniques
Intensity Transformations and Spatial Filtering: Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters and sharpening spatial filters.
Filtering in the Frequency Domain:image smoothing using frequency domain filters, Image Sharpening using frequency domain filters.

UNIT-III- Image Restoration
Image Restoration : A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering. Estimating the image degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering.

UNIT-IV- Image compression and Segmentation
Image compression: Fundamentals, Basic compression methods: Huffman coding,Arithmetic coding, LZW coding **a**nd subband coding.
Image segmentation: Fundamentals, point, line, edge detection, thresholding, based segmentation and simple morphological operations :Erosion and dilation, opening and closing.

UNIT-V- Color image processing
Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening.

Text Books

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. **J**ayaraman, S. Esakkirajan, and T. Veerakumar,‖ Digital Image Processing‖, Tata McGraw Hill Education, 2011.

Reference Books

1. Anil K.**J**ain, -Fundamentals of Digital Image Processing‖, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, -Digital Image Processing and Analysis‖, PHI, 2009.

Sem.	Medical Electronics (Open Elective)	Course Code: V20ECTOE04	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Explain the basics concepts of Bio-Medical Instrumentation. **(K2)**
CO2: Explain the concepts of electrode theory, classification of Electrodes and Transducers used in Bio-Medical Applications. **(K2)**
CO3: Explain the Anatomy and Physiology of Cardiovascular system and Illustrate the application of Bio-Medical Instruments to measure the Physiological parameters of Cardiovascular System **(K2)**
CO4: Discuss the elements used for Patient's Health care &monitoring. **(K2)**
CO5: Classify different types of monitors, discuss the principals of recorders and Illustrate the methods of accident preventions **(K2)**

UNIT-I:

INTRODUCTIONTOBIOMEDICALINSTRUMENTATION: AgeofBiomedicalEngineering,Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials, Muscle, Bioelectric Potentials, Sources of Bioelectric Potentials, Resting and Action Potentials, Bioelectric Potentials-ECG, EEG and EMG,

UNIT-II:

ELECTRODES AND TRANSDUCERS: Introduction, Electrode Theory, Bio potential Electrodes, Examples of Electrodes, Basic Transducer Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Pulse Sensors, Respiration Sensor, Transducers with Digital Output.

UNIT-III:

CARDIOVASCULAR SYSTEM AND MEASUREMENTS: The Heart and Cardiovascular System, Electrocardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart Sounds, Plethysmography.

UNIT-IV:

PATIENTCAREANDMONITORING: ElementsofIntensive-CareMonitoring,PatientMonitoringDisplays, Diagnosis, Calibration and Repair ability of Patient-Monitoring Equipment, Other Instrumentation for Monitoring Patients, Organization of the Hospital for Patient-Care Monitoring, Pacemakers, Defibrillators.

UNIT-V:

DIAGNOSTIC TECHNIQUES AND BIO-TELEMETRY: Principles of Ultrasonic Measurement, Ultrasonic Imaging, Ultrasonic Applications of Therapeutic Uses, Ultrasonic Diagnosis, X-Rayand Radio-Isotope Instrumentations, CAT Scan, Emission Computerized Tomography, MRI, Introduction to Biotelemetry, Physiological Parameters Adaptable to Biotelemetry, The Components of Biotelemetry System, Implantable Units, Telemetry for ECG Measurements during Exercise, Telemetry for Emergency Patient Monitoring.

Text Books:

1. Bio-Medical Electronics and Instrumentation, OnkarN.Pandey, RakeshKumar, KatsonBooks.
2. Bio-Medical Instrumentation, Cromewell, Wiebell, Pfeiffer

References:

1. Hand Book of Bio-Medical Instrumentation‖, Khandapur. McGrawHill
2. Introduction to Bio- Medical Equipment Technology‖, 4thEdition, Joseph J.Carr, John M.Brown, Pearson Publications.

Sem.	Principles of Wireless Communication (Open Elective)	Course Code: V20ECTOE05	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO1: Discuss the cellular system evolution of mobile radio systems **[K2]**
CO2: Illustrate the basic cellular concepts. **[K2]**
CO3: Explain the Various Propagation models. **[K2]**
CO4: Discuss the need of modulation, diversity and equalization in cellular & Mobile Communication. **[K2]**
CO5: Demonstrate the knowledge about GSM architecture, &upcoming technologies like 3G, 4G etc. **[K2]**

UNIT-I: Introduction of Wireless Communication History and evolution of mobile radio systems: Types of mobile wireless services/systems, WLL, Paging, Satellite systems.

UNIT-II: Cellular Concepts and System Design Fundamentals: Cellular concept and frequency reuse, channel assignment, handoff strategies, cell splitting,cell sectoring.

UNIT-III: Mobile radio Propagation Models: Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading.

UNIT-IV: Overview analog and digital modulation techniques Need For Modulation.

UNIT-V: Digital cellular networks: GSM architecture, GSM Services, multiple access schemes; FDMA, TDMA, CDMA, OFDMA;

Higher Generation Cellular Standards: 3G System architecture (UMTS), 4G System Architecture, Introduction to 5G.

Text Books

1. Theodore S. Rappaport, —wireless communications Principles and Practices‖, PHI, 2005
2. Jochen Schiller, —Mobile Communications‖, Pearson Education, second edition, 2009.

Reference Book

1. Lee W.C.Y, —Mobile communication Engineering
2. Theory and Applications‖ , 2/e McGraw-Hill,New York, 2003
3. Andreas F. Molisch, —Wideband Wireless Digital Communication‖ , Pearson Education 2001.

Sem.	Basic of VLSI Design (Open Elective)	Course Code: V20ECTOE06	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes:
After Successful completion of the Course, the student will be able to:

CO1. Identify the CMOS layout levels, and the design layers used in the process sequence. **(K2)**
CO2. Describe the general steps required for processing of CMOS integrated circuits. **(K2)**
CO3. Outline static CMOS combinational and sequential logic at the transistor level. **(K1)**
CO4. Demonstrate different logic styles such as complementary CMOS logic, pass-Transistor Logic, dynamic logic, etc. **(K3)**
CO5. Interpret the need for testability and testing methods in VLSI. **(K3)**

UNIT-I:

Moore's law, speed power performance, n-MOS fabrication, CMOS fabrication: n-well, well processes, Bi-CMOS, Comparison of bipolar and CMOS. Basic Electrical Properties of MOS And Bi-CMOS Circuits: Drain to source current versus voltage characteristics, threshold voltage, trans conductance.

UNIT-II:

Basic Electrical Properties of MOS And Bi-CMOS Circuits: n-MOS inverter, Determination of pull up to pull down ratio: n-MOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, Bi-CMOS inverters, latch up.
Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, Bi-CMOS drivers.

UNIT-III:

MOS and Bi-CMOS Circuit Design Processes: MOS layers, stick diagrams, n-MOS design style, CMOS design style Design rules and layout & Scaling of MOS Circuits: λ - based design rules, scaling factors for device parameters

UNIT-IV:

Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo n-MOS, Dynamic CMOS Examples of structured design: Parity generator, Bus arbitration, multiplexers, logic function block, code converter.

UNIT-V:

Subsystem Design and Layout-2: Clocked sequential circuits, dynamic shift registers, bus lines, General considerations, 4-bit arithmetic processes, 4-bit shifter, Regularity-Definition & Computation Practical aspects and testability: Some thoughts of performance, optimization and CAD tools for design and simulation.

Text Books:

1. -Basic VLSI Design‖, Douglas A Pucknell, Kamran Eshraghian, 3rd Edition, Prentice Hall of India publication, 2005.

References:

1. -CMOS Digital Integrated Circuits, Analysis And Design‖, Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3rd Edition, 2003.
2. -VLSI Technology‖, S.M. Sze, 2nd edition, Tata McGraw Hill, 2003.

Sem.	Concepts of Embedded Systems (Open Elective)	Course Code: V20ECTOE07	L	T	P	C
			2	0	2	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Describe the Basic Concepts of embedded systems- **(K2).**
CO-2: Describe the characteristics of Application & Domain-Specific Embedded Systems - **(K2)**
CO-3: Explain the various elements of embedded hardware and their design principles- **(K2)**
CO-4: Explain various software design approaches in embedded environment- **(K2)**
CO-5: Discuss various tools used for Embedded system implementation and testing - **(K2)**

UNIT I - INTRODUCTION TO EMBEDDED SYSTEMS:

Introduction to Embedded Systems, Classification of Embedded systems, Major application areas of embedded systems, Purpose of embedded Systems, The Typical embedded system - core of the embedded system, Difference between RISC and CISC, Types of Memories.

UNIT II - CHARACTERISTICS OF EMBEDDED SYSTEM:

Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

UNIT III - EMBEDDED HARDWARE DESIGN:

Analog Electronic Components, Digital electronic components, I/O types and examples, Serial communication devices (I2C, SPI, USB), GPRS, Watchdog timer, Real time Clock,Sensors and Actuators.

UNIT IV - EMBEDDED FIRMWARE DESIGN:

Embedded Firmware design approaches, Embedded Firmware development languages: Assembly level and High-level Programming Language, Advantages and Drawbacks of development languages, Concepts of C versus Embedded C and Compiler versusCross-compiler.

UNIT V - EMBEDDED SYSTEM IMPLEMENTATION AND TESTING:

The main software utility tools - IDE and CAD, Translation tools - Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard,ElsevierPublications,2013
2. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited,2013.

References:

1. Embedded Systems: Architecture, Programming and Design by Raj Kamal, Tata McGraw-Hill Education, 2011.
2. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications,2013.
3. Embedded/Real Time Systems by KVKK Prasad by Dreamtech Publication

V Sem.	Hardware Modelling using Verilog	Course Code	L	T	P	C
		V20HONECT02	3	-	-	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1: Describe VLSI design flow and standard cell based design. **[K2]**

CO2: Discuss various concepts of verilog, Simulation and Synthesis. **[K2]**

CO3: Develop digital systems using various modelling styles. **[K3]**

CO4: Synthesize Combinational and Sequential circuits. **[K6]**

CO5: Construct Memories and Processors using Verilog. **[K3]**

Unit I: VLSI Design Process

Introduction to IC Technologies, Moore's law, VLSI design flow, Needfor CAD tools,HDLs, design representation, Y (wye) diagram, physical design, design style, FPGA, look up table, FPGA design flow, Gate Array

Standard Cell based Design: Characteristic of the Cells, Standard cell example, Floor plan for standard cell Design, Standard cell Layout, Full Custom Design.

Unit II: Verilog Concepts and Conventions

Need of Verilog, Module, Simulation, Synthesis, Test Bench, Concepts of Verilog: Module, Data Types, Data Values and Signal Strengths, Scalars and Vectors, Multidimensional Arrays and Memories, Constants, Parameters. Some Recommended Practices: Naming Conventions, Comments, Coding Style, Module Partitioning, General Coding Techniques, General Guidelines for Synthesis.

Unit III: Modelling Concepts

Switch Level Modeling: Introduction, Various Switch Primitives in Verilog, Various gate primitives in switch level, Strengths, Predefined Logic Gates in Verilog, The timescale directive, Specifying connectivity during Instantiation, Hardware Modelling Issues.

Behavioural representation, Structural representation, Physical representation with examples, Operators, Verilog modelling examples, Assignment statements : Continuous and Procedural Assignments, Blocking and Non – Blocking Assignments, Verilog Test bench, The Simulator Directives.

Unit IV: Modelling Combinational and Sequential Circuits

User Defined Primitives(UDP), Rules, Guidelines, Modelling Combinational Circuits, Modelling Sequential Circuits, Modelling Finite State machines: Introduction to FSM, Mealy and Moore Types, Data Path and Controller Design: Introduction, The Data Path, The Control Path, The Test bench for Data Path and Control path.

Synthesizable Verilog:

Thesis rules for combinational logic, Styles for synthesizable Combinational Logic : Gate Netlist, Using Continuous Assignments, Using Procedural blocking Assignments, Using Functions in Verilog, Using Tasks, Constructs to avoid for Combinational Synthesis, Synthesizable & Non – Synthesizable Verilog Constructs.

Unit V: Memories and Processors

Guidelines to Model Memories, Initializing Memory: from a file, Single – port RAM with synchronous read / write, Single – port RAM with asynchronous read / write, A ROM / EPROM, Modelling Register Banks: Introduction, 4 × 32 Register Bank, 32 × 32 Register Bank, Basic Pipelining Concepts, Examples of Pipelining Modelling, Clocking Issue in Pipelining, Pipeline Implementation of a ProcessorMIPS32(Non – Pipelined & Pipelined), Verilog Implementation of MIPS32, Running Example Programs on the Processor.

TEXT BOOKS:

1. Design Through Verilog Hdl By T.R. Padmanabhan, B.Bala Tripura Sundari, 2008
2. Modeling, Synthesis, and Rapid Prototyping with the VERILOG (TM) HDL 1st Edition By Michael D. Ciletti

REFERENCE BOOKS:

1. Verilog HDL Synthesis, A Practical Primer By J. Bhasker · 2018
2. Verilog HDL A Guide to Digital Design and Synthesis · Volume 1 By Samir Palnitkar · 2003

V Sem.	Introduction to Semiconductor Devices	Course Code V20MINECT01	L	T	P	C
			3	-	-	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to

CO1: Explain the basic concepts of Semiconductor Physics. **(K2)**
CO2: Discuss the basic concepts of PN Junction Diode. **(K2)**
CO3: Interpret the Input & Output characteristics of BJT in different Configurations**. (K2)**
CO4: Explain the construction, principle of operation of J-FET Drain & Transfer characteristics**. (K2)**
CO5: Discuss the construction, principle of operation of Enhancement & Depletion MOSFET characteristics**. (K2)**

Unit-I: Semiconductor Physics: Semiconductors in daily life, Energy band formation, Band gap and Material classification-Conductors, Insulators & Semi- Conductors. Intrinsic & Extrinsic Semiconductors, Fermi level, Fermi level in Intrinsic & Extrinsic semiconductors.

Unit-II: Junction Diode Characteristics: PN junction diode, Current components in PN junction Diode,Diode equation, V-I Characteristics, Diode resistance, Diode Capacitance,ZenerDiode,Breakdown mechanisms, LED, applications.

Unit-III: **BJT Characteristics :** Junction transistor , transistor current components, transistor equation, Transistor Configurations & Regions of Operation, Characteristics of transistor in Common Base, Common Emitter and Common Collector configurations.

Unit-IV: **J-FET Characteristics**: FET Classification J-FET Construction, operation, Drain Characteristics, Transfer Characteristics and Parameters-Drain Resistance(r_d),Trans Conductance(g_m) and Amplification Factor(μ).

Unit-V: **MOSFET Characteristics**: MOSFET- types, Enhancement MOSFET: Construction, operation, Characteristics, DepletionMOSFET: Construction, operation, Characteristics.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition
2. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition
3. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, Second Edition
4. Electronic Devices and Circuits – R.L Boylestad and Louis Nashelsky, Pearson Publications

References

1. Integrated Electronics- Jacob Millman, C. Halkies, C.D.Parikh, Tata Mc-Graw Hill, 2009.
2. Electronic Devices and Circuits-K. Satya Prasad, VGS Book Links.
3. Electronic Devices and Circuits – Bell, Oxford
4. Electronic Devices and Circuits-A.PGodse, U.A.Bakshi,Technical publications

Minors	Principles of Digital Circuits	Course Code: V20MINECT02	L	T	P	C
			3	-	-	3

Syllabus Details

Course Outcomes: After Successful completion of this course, the students will be able to:

CO1: Discuss Boolean functions and various Combinational Circuits **[K2]**

CO2: Analyze various Sequential Circuits **[K3]**

CO3: Implement designs using Programmable Logic Devices**[K3]**

CO4: Discuss various Logic Families.**[K2]**

CO5: Discuss Semiconductor memories **[K2]**

UNIT-I

Boolean algebra and logic gates : Introduction to Boolean Algebra and Logic Gates, Simplification of Boolean Functions using Karnaugh map (4 variable), Combinational Circuits – Binary Adder-Subtractor, Decoders, Encoders, Multiplexers.

UNIT-II

Sequential Logic: Sequential Circuits: Latches, Flip-Flops, Basics of Counters and Shift Registers.

UNIT-III

Memory and Programmable Logic: RAM – Memory Decoding, ROM - Programmable Logic Array – Programmable Array Logic.

UNIT-IV

Logic Families : Introduction to TTL, ECL, MOS & CMOS, their operation and specifications.

UNIT-V

Semiconductor Memories: Introduction to – RAM, ROM, EPROM, EEROM, SRAM, DRAM.

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, —Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog‖, 6th Edition, Pearson Education, 2017.
2. A. K. Maini, "Digital Electronics: Principles, Devices And Applications, Wiley, 2007.

REFERENCES:

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013.

V Sem.	Synthesis of Digital systems	Course Code	L	T	P	C
		V20HONECT01	3	-	-	3

Syllabus Details

Course Outcomes: After Successful completion of the Course, the student will be able to:

CO-1: Discuss about digital systems modeling with VHDL. **(K2)**

CO-2: Describe High level synthesis and its processes **(K2)**

CO-3: Illustrate various Scheduling methods **(K3)**

CO-4: Analyze timing issues in High level synthesis and FSM encoding methods. **(K4)**

CO-5: Illustrate Retiming, optimization methods and timing. **(K3)**

UNIT-I:

Introduction to digital systems with VHDL: Outline what is synthesis, Chip design flow and hardware modeling, Introduction to Hardware Description Languages & VHDL Basics, VHDL: Modeling Timing - Events & Transaction, VHDL: Specifying Hardware Behaviour with Processes, Specifying Structure, Test Benches, Parameterisation, & Libraries

UNIT-II:

High level synthesis and its processes:

Introduction to High-level Synthesis, Language front-end Design Representation, Compiler Transformation in High Level Synthesis: Constant Folding, Memory Modeling & Compiler Transformation in High Level Synthesis, Compiler Transformations in High Level Synthesis: Loop Unrolling and Function Inlining

UNIT-III:

Hardware Transformations and Scheduling:

Hardware Transformations: Tree height reduction, Control flow to data flow, Flow graph flattening, Pattern Matching.

Scheduling: Importance of Scheduling, Basic Scheduling, Scheduling with unlimited resources: ASAP Scheduling Algorithm, ALAP Scheduling, Resource constrained Scheduling: List Scheduling, Time-constrained Scheduling, Force Directed Scheduling & Register Allocation

UNIT-IV:

High level synthesis and FSM analysis High Level Synthesis and Timing Issues, Finite State Machine Synthesis: Introduction to FSM Encoding, Finite State Machine Synthesis: Identifying Common Cubes & Graph Embedding,

UNIT-V:

Retiming, logic synthesis and optimization, timing analysis: The Retiming Problem, Efficient Solution to Retiming & Introduction to Logic Synthesis, Binary Decision Diagrams, Introduction to Logic Synthesis, Two-level Logic Optimisation, Multi-level Logic Synthesis: Technology Mapping, timing analysis and critical path.

Text Books:

Giovanni de Micheli, Synthesis and Optimization of Digital Circuits, McGraw Hill
High Level Synthesis Introduction to chip and system design edited by Daniel D Gajski

REFERENCE BOOKS:

Philippe Coussy, Adam Morawiec: High-level synthesis from Algorithm to digital circuit, Springer 2008.
The Synthesis Approach to Digital System Design Petra Michel, Ulrich lauther, Peter Duzy.