PVP 19

CONTENTS

PVP 19

1. SHORT TITLE AND COMMENCEMENT

a. The regulations listed under this head are common for all degree level undergraduate programmes (B.Tech.), offered by the college with effect from the academic year 2019-20 and they are called as "PVP19" regulations.
b. The regulations hereunder are subjected to amendments as may be made by the Academic Council of the college from time to time, keeping in view of the recommendations of the Board of Studies. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the programme, as may be decided by the Academic Council.

2. DEFINITIONS

a. "Commission" means University Grants Commission (UGC);
b. "Council" means All India Council for Technical Education (AICTE);
c. "University" means Jawaharlal Nehru Technological University Kakinada (JNTUK);
d. "College" means Prasad V. Potluri Siddhartha Institute of Technology, Vijayawada;
e. An Academic Programme means any combination of courses and/or requirements leading to award of a degree.
f. "Course" means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.
g. "Degree" means an academic degree conferred by the university upon those who complete the undergraduate curriculum.
h. "CBCS" means Choice Based Credit System
i. "MOOC" means Massive Open Online Course
j. "Regular Students" means students enrolled into the four year programme in the first year.
k. "Lateral Entry Students" means students enrolled into the four year programme in the second year.

3. ACADEMIC PROGRAMMES

3.1 Nomenclature of Programmes

3.1.1 The nomenclature and its abbreviation given below, shall continue to be used for the Degree programmes under the University, as required by the Council and the Commission:

Bachelor of Technology (B. Tech)

Besides, the name of specialization shall be indicated in brackets after the abbreviation, for example, engineering degree in Mechanical Engineering programme is abbreviated as B.Tech (Mechanical Engineering).

3.1.2 Bachelor of Technology (B. Tech.) degree programme is offered in:

1. Civil Engineering (CE)
2. Computer Science and Engineering (CSE)
3. Electronics and Communication Engineering (ECE)
4. Electrical and Electronics Engineering (EEE)

5. Information Technology (IT)
6. Mechanical Engineering(ME)

4. DURATION OF THE PROGRAMMES

4.1 Normal Duration

4.1.1. The duration of an academic programme shall be four years consisting of eight semesters.

4.1.2. The duration of the programme for lateral entry students who are admitted in II year shall be three years that consists of six semesters.

4.2 Maximum Duration

4.2.1 The maximum period for which a student can take to complete a full time academic programme shall be double the normal duration of the programme, i.e., for regular students eight years, for lateral entry students six years.

4.3 Minimum Duration of a Semester

Each semester consists of a minimum of 90 instruction days with aboutminimum 20 and maximum 33 contact hours per week.

5. ADMISSION CRITERIA

The eligibility criteria for admission into UG Engineering programmes are as per the norms approved by Government of Andhra Pradesh from time to time.

The sanctioned seats in each programme in the college are classified into CATEGORY-A, and CATEGORY-B at I year level and only CATEGORY-A at Lateral Entry II year level.

The percentages of Category–A, Category-B and Lateral Entry Seats are decided from time to time by the Government of Andhra Pradesh.

5.1 CATEGORY – A Seats

Category - A seats are filled as per the norms approved by the Governmentof Andhra Pradesh.

5.2 CATEGORY – B Seats

Category - B seats are filled by the College as per the norms approved bythe Government of Andhra Pradesh.

5.3 CATEGORY - Lateral Entry Seats

Lateral entry candidates shall be admitted into the III semester directly asper the norms approved by Government of Andhra Pradesh.

6. CREDIT SYSTEM AND GRADE POINTS

6.1 Credit Definition

'Credit' means quantified and recognized learning. Credit is measured in terms of contact hours per week in a semester. Typically one credit is given to:

(a) Theory/Tutorial course conducted for one contact period.

(b) Laboratory course conducted for two contact periods.

Each course is assigned a certain number of credits depending upon the number of contact hours (Lectures/Tutorials/Practical) per week.

The curriculum of the eight semesters B.Tech program is designed to have a total of 160 credits for the award of B.Tech degree.

For lateral entry students, the curriculum of six semesters B.Tech program is designed to have a total of 121.5 credits for the award of B.Tech degree.

6.2 Semester Course Load

The average course load shall be fixed at 20 credits per semester with its minimum and maximum limits being set at 13 and 24.5 credits.

6.3 Grade Points and Letter Grade for a Course

The grade points and letter grade will be awarded to each course based onstudent's performance as per the grading system shown in the Table1.

Table 1: Grading System for B. Tech Programme

Theory/Drawing % of Marks	Laboratory/Project % of Marks	Grade Points	Letter Grade
≥ 90%	≥ 90%	10	S
80 – 89%	80 – 89%	9	A
70 - 79%	70 - 79%	8	B
60 - 69%	60 - 69%	7	C
50 - 59%	55 - 59%	6	D
40 - 49%	50 – 54%	5	E
< 40%	< 50%	0	F (FAIL)
ABSENT	ABSENT	0	AB

6.4 Semester Grade Points Average (SGPA)

The performance of each student at the end of the each semester is indicated in termsof SGPA calculated as shown in equation (1).

$$SGPA = \frac{\sum(CR \times GP)}{\sum(all\ courses\ offered\ in\ the\ semester)} \quad -(1)$$

Where CR= Credits of a course

GP= Grade Points awarded for a course

6.5 Cumulative Grade Point Average (CGPA)

The Cumulative Performance of each student at the end of each semester is indicated in terms of CGPA which is calculated as shown in equation (2).

$$CGPA = \frac{\sum CR\ X\ GP}{\sum CR(for\ all\ courses\ offered\ upto\ that\ semester/entire\ program)}$$

Where CR = Credits of a course

GP = Grade points awarded for a coursePercentage equivalent of CGPA = (CGPA – 0.5) * 10 -- (2)

7. CURRICULUM FRAMEWORK

7.1 General Issues

7.1.1 Curriculum framework is important in setting the right direction for a degree programme as it takes into account the type and quantum of knowledge necessary to be acquired by a student in order to qualify for the award of degree in his/her chosen branch or specialization.

7.1.2 Besides, this also helps in assigning the credits for each course, sequencing the courses semester-wise and finally arriving at the total number of courses to be studied and the total number of credits to be earned by a student in fulfilling the requirements for conferment of degree.

7.1.3 Each theory course shall consist of five units.

7.2 Curriculum Structure

The curriculum is designed to facilitate CBCS and incorporates courses required to attain the expected knowledge, skills and attitude by the time of graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories (as described in 7.2.1 to7.2.6) to coverthe depth and breadth required for the programme and for the attainment of programme outcomes of the corresponding programme.

7.2.1 Institutional Core

Institutional Core consists of the courses required for all UG Engineering Programmes offered in this college. The courses offered under this category cover the required knowledge in the following areas:

(a) Basic Sciences:

Basic Science courses include Engineering Physics, Applied Physics, Engineering Physics Lab, Applied Physics Lab Engineering Chemistry, Chemistry of Materials, Engineering Chemistry Lab, Chemistry of Materials Lab, Mathematics I (calculus and Algebra), Engineering Mathematics II (ODE, PDE and Multivariable Calculus), Engineering Mathematics III, Engineering Mathematics IV, Life Sciences for Engineers and Life Sciences for Engineers Lab.

(b) Engineering Sciences:

Engineering Science courses include Problem Solving and Programming, AI Tools, Internet of Things, Design Thinking & Product Innovation, Basic Electrical and Electronics Engineering, Engineering Graphics, Problem Solving & Programming Lab, Basic Electrical & Electronics Engineering Lab, AI Tools Lab, Internet of Things Lab, Design Thinking and Product Innovation Lab and Basic Workshop.

(c) Humanities and Social Sciences:

Humanities and Social Science Courses consist of Communicative English I, Communicative English II, HS-I (Engineering Economics& Management), HS-II (Organizational Behavior), Communicative English I Lab and Communicative English II Lab.

7.2.2 Elective Courses

Elective courses are offered across the programmes to enhance the knowledge breadth and professional competency of the students.

Courses	Branch Specific	Compulsory
Elective courses	Program Electives	Supportive to the discipline courses with expanded scope in a chosen track of specialization or cross track courses
	Interdisciplinary Electives	Interdisciplinary exposure & nurture the student interests in other department courses
	Open Electives	Common to all disciplines that helps general interest of a student

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (MOOCs) during the period of study. Students without any backlog courses upto III semester are permitted to register for MOOCs from IV semester onwards upto a maximum of 15 credits from Program Elective/Interdisciplinary Elective/Open Elective Courses. However, the Departmental Committee (DC) has to approve the courses under MOOCs. The Departmental committee consists of Head of the Department, Program coordinator and Module Coordinator.

Students can register and complete the opted course in approved MOOCs platform on or before the last instruction day of IV/V/VI/VII semester. They have to submit the pass certificate before the last instruction day of that concerned semester.

7.2.3 Programme Core

The Programme core consists of set of courses considered which are necessary for the students of the specific programme. The courses under this category satisfy the Programme Specific Criteria prescribed by the appropriate professional societies.

7.2.4 Project

Project Phase I & Project Phase II will be initiated in VII semester and completed before the end of VIII semester.

Project Phase I can be done by a group of students, working under theguidance of a faculty member and carrying out a detailed feasibility study, literature survey and submit a report regarding work plan for theproject phase II.

Project Phase II involves continuation of Project Phase I. The objective is to complete the work as per the prepared work plan and submit a detailed project report.

7.2.5 Industry Interaction

The students may register for either Internship or Industry offered course during the summer break after VI semester to secure 2 credits.

Internship/Industry offered courses are purely meant for internal Assessment which will be evaluated for 75 marks during the VII semester.

a) Internships

The students may undergo Internship for 3 to 6 weeks duration in the industry approved by respective head of the department at the end ofVI semester.

b) Industry offered courses

The students can opt for the courses under this category that are offered by the Industry experts whose minimum academic qualification is Bachelor of Engineering or equivalent.

7.2.6 Mandatory Learning Courses

According to the guidelines given by statutory bodies, Courses on Environmental Science, Constitution of India and Engineering Ethics shall be offered.

Induction program shall be offered in I semester for all the branches.

NCC/NSS/NSO/YOGA shall be offered in I & II semesters.

Environmental Science and Constitution of India shall be offered in III & IV semesters.

Engineering Ethics shall be offered in V/VI semesters.

Academic Rules and Regulations PVP19

7.3 Course Numbering Scheme

The Course code consists of eight/nine characters. The following is the structure of the course Code (Figure 1).

1 9	**C S**	**1**	**2**	**0**	**3**	**A**
egulation	**Course Category**	**Kind of course**	**Semester**	**Type**	**Course Number**	**[Elective code]**
Last two digits of Regulation offered (i.e. 19 for PVP19 regulations)	HS - Humanities and Social Sciences including Management courses BS - Basic Science courses ES - Engineering Science MC - Mandatory Courses. In case of Professional Core/ Professional Elective courses department code is placed: CE - Civil Engineering CS - Computer Science & Engineering EC - Electronics & Communication Engineering EE - Electrical & Electronics Engineering IT - Information Technology ME - Mechanical Engineering	1. Institutional Core (i.e. HS, BS,ES, MC) 2. Inter Disciplinary Elective 3. Program Core 4. Program Elective 5. Open Elective	1. First 2. Second 3. Third 4. Fourth 5. Fifth 6. Sixth 7. Seventh 8. Eight	1. Theory 2. Theory studied in MOOCS Mode 3. Practical 4. Project Work 5. Industrial Training/ Internship	i.e. Course sequence Number in that semester	Incase if the course is Elective then this field will specifythe elective code (i.e. A, B, C.)

Figure 1: Course numbering scheme

7.4 Medium of Instruction and Examination

The medium of instruction and examinations shall be English.

7.5 Registration

Every student has to register himself/herself for the courses in each semester individually at the time as specified in academic calendar.

8. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) shall be introduced with effect from 2019-20 academic year, based on guidelines of the statutory bodies in order to promote:

- Activity based learning
- Student centered learning
- Students to choose courses of their choice
- Learning at their own pace
- Interdisciplinary learning

Flexibility is extended to the fast learning students to take the courses of higher semesters in advance as per their convenience to concentrate on their placement activity/ project work, etc., during the VII/VIII semesters.

8.1 CBCS Course Registration Policy

Fast learning students can register for additional courses from higher semesters by satisfying the pre-requisite course(s) to a maximum of 8 credits in each of the semesters from III semester onwards along with the regular semester courses as prescribed. There is no minimum limit to the credits for taking additional courses.

Eligibility for choosing CBCS flexibility:

- **Regular Students (4 Year duration),** entering the n^{th} semester with no backlog courses up to $(n-1)^{th}$ semester, are only eligible to opt for this flexibility.
- **Lateral entry students (3 year duration)** with 70% Marks in their Diploma are eligible to opt for this flexibility during III and IV Semesters. Those students entering into V/ VI /VII semester with no backlog courses up to $(n-1)^{th}$ semester, are only eligible to opt for this flexibility.

  The list of additional courses offered in the even & odd semesters, registration dates will be notified by the respective departments well in advance.

  A student can withdraw from the respective course within 15 days after the commencement of the course.

  The choice of utilizing this flexibility is purely optional to the students.

  A minimum number of students required to register for an additional course shall be twenty (20). In case, the registered strength for the additional course is less than twenty (20), the course may be offered on the recommendation of the Head of the Department and subsequent approval of the Principal.

8.2 Continuous Internal Evaluation (CIE) for CBCS opted Courses

The contact hours, continuous assessment pattern, eligibility criteria to write end semester examinations and revaluation scheme for these additional courses will be as per the current academic regulations [PVP19].

8.3 Eligibility to appear CBCS registered courses for Semester End Examinations

The registered additional courses will be dealt separately as individual courses for the calculation of attendance and continuous assessment of marks for assessing the eligibility to write the end semester examinations for these courses.

The performance of the student in the registered additional courses will be separately mentioned in the semester end grade card and it will not be taken into account for the calculation of the SGPA for that semester.

The performance of the student in the registered additional courses will be taken into account in the corresponding semesters.

8.4 CBCS Course Detention

8.4.1 In case, the student is detained for want of minimum specified attendance and continuous assessment marks criterion either in the regular semester or in the additional courses, he/she will forfeit the eligibility for registering additional courses from that semester onwards. However, the additional courses completed by the students in the earlier semesters will be valid and taken into consideration.

8.4.2 In case, the student is detained for want of minimum specified attendance and continuous assessment marks criterion in the regular semester but meets minimum specified attendance and continuous assessment marks criterion in the registered additional courses, he/she shall write the end semesterexaminations for these additional courses along with the regular students in the corresponding semester only.

8.4.3 In case, the student fails/is absent in the end semester examinations of the registered additional courses or in the regular semester courses in a particular semester, he will forfeit the eligibility for registering additional courses from that semester onwards. However, the additional courses completed by the students in the earlier semesters will be valid and taken into consideration. They can write the end semester examinations for additional courses in which they failed/were absent, along with regular students in the corresponding semesters only.

8.4.4 The criterion for the promotion to higher semesters will be as per PVP19 regulations, taking only the regular semester courses into consideration for the fast learners.

8.4.5 Additional courses, in which the fast learning student fails, will not be considered as backlogs for them.

8.4.6 The fast learning students shall register for all the courses of a regular semester excluding the courses completed in the previous semesters.

8.4.7 The credits scored by students through CBCS subjects shall not be considered for credit promotion from II year to III year or from III year to IV year B.Tech.

8.4.8 The student opting for the said flexibility will be considered for the award of thedivision on par with other regular students.

8.4.9 The students who have earlier history of indulging in malpractices in semester endexaminations are not eligible for opting CBCS.

8.4.10 If the student fails to register for opted CBCS courses for semester end examination, he/she will forfeit the eligibility for registering additional courses

from that semester onwards and marks secured through continuous assessment will not be considered.

8.4.11 The choice of utilizing this flexibility is purely optional to the students.

8.4.12 If a student fails/absent in a CBCS course, he/she is bound to appear in the same course when studied in regular semester.

9. EXAMINATIONS & SCHEME OF EVALUATION

9.1 Description of Evaluation

9.1.1 Continuous Internal Evaluation (CIE): The performance of the student in each course is evaluated by the faculty/course coordinator all through the semester; with mid-term tests (sessional-1and sessional-2), assignments, project reviews, viva-voce, laboratory assessment and other means covering the entire syllabus of the course.

9.1.2 Semester End Examination (SEE): It shall be conducted by chief controller ofexaminations at the end of each semester, as per the academic calendar and with a written examination for theory courses and practical/project examination with built-in oral part for laboratory/project.

9.2 Continuous Internal Evaluation (CIE)

9.2.1 Theory Courses

Each course is evaluated for 30 marks (a+b+c)

a) Two assignment tests (Assignment Test-1 & Assignment Test-2) for 10 marks each will be conducted with1 hour duration. Assignment-1 shall be conducted from Unit-1 and Assignment-2 shall be conducted from Unit-4. The assignment test marks shall be awarded taking the average of twoassignment tests.

The Assignment test shall be held in the zero hour and the class work will be conducted as usual in those days.

The Question bank with minimum number of 6 comprehensive questions from the concerned UNIT of the syllabus will be given to students at least a week in advance before the commencement of Assignment Test.

The question paper shall contain 2 comprehensive questions, each one is meant for 5 Marks. The student is required to answer all the questions.

b) Home assignment shall be conducted for 5 marks from Unit-3. The question bank with 10 to 15 comprehensive questions from unit-3 shall be given to students. Each student has to answer 3 questions from the question bank which will be assigned by the concerned faculty.

c) Two Mid-term (Sessional - 1 and Sessional - 2) examinations with 15 Marks each shall be conducted with **90 minutes** duration.

The Mid-term marks shall be awarded taking the average of two Mid-term examinations.

The question paper shall be given in the following pattern:

Part A: Contains two questions, one from each unit. The student shall answer all questions. Each question is for 2.5 marks.

Part B: Contains four questions. Two questions shall be given from each unit with internal choice. The student shall answer 1 question from each unit. Each question carries 5 marks.

Syllabus for CIE

Name of the Test	**Syllabus**
Assignment Test – 1	UNIT – I
Sessional – 1	UNIT - I & UNIT – II
Home Assignment	UNIT – III
Assignment Test – 2	UNIT – IV
Sessional – 2	UNIT – IV& UNIT – V

The questions shall be framed in Assignment tests and Sessional examinations in line with the Course Outcomes defined and cognitive levels.

9.2.2 Mandatory Learning Courses

Each course is evaluated for 100 marks (a+b)

a) Two Mid-term (Sessional - 1 and Sessional - 2) examinations each for 40Marks shall be conducted with **90 minutes** duration.

The Mid-term examinations shall be held in the zero hour and the class work shall be conducted as usual in those days.

The question paper shall be given in the following pattern:

The question paper contains four questions. Two questions shall be given from each unit with internal choice. The student shall answer one question from each unit. Each question carries 20 marks.

b) Home assignment for 20 marks shall be conducted from Unit-3. The question bank with 10 to 15 comprehensive questions from unit-3 shall be given to students. Each student has to answer 4 questions from the question bank which will be assigned by the concerned faculty.

The Mid-term marks shall be awarded as sum of two Mid-term examinations and home assignment.

Syllabus for CIE

Name of the Test	**Syllabus**
Sessional – 1	UNIT – I & II
Home Assignment	UNIT – III
Sessional – 2	UNIT – IV & V

9.2.3 Drawing Based Courses:

Each course is evaluated for 30 marks (a+b)

a) Two Mid-term (Sessional - 1 and Sessional - 2) examinations with 15 Marks each shall be conducted with **90 minutes** duration.

The Mid-term examinations shall be held in the zero hour and class work shall be conducted as usual in those days.

The Mid-term marks shall be awarded taking the average of two Mid-term examinations.

The question paper shall be given in the following pattern:

Part A: Contains two questions, one from each unit. The student shall answer all questions. Each question is for 2.5 marks.

Part B: Contains four questions. Two questions shall be given from each unit with internal choice. The student shall answer 1 question from each unit. Each question carries 5 marks.

b) Home assignment shall be conducted for 5 marks from Unit-3. The question bank with 10 to 15 comprehensive questions from unit-3 shall be given to students. Each student has to answer 3 questions from the question bank which will be assigned by the concerned faculty.

Syllabus for CIE

Name of the Test	Syllabus
Sessional – 1	UNIT – I & II
Home Assignment	UNIT – III
Sessional – 2	UNIT – IV & V

The distribution of marks for continuous internal evaluation is given in the Table 2:

Table 2: Distribution of Marks (CIE)

S. No.	Criterion	Marks
1	Day to Day Evaluation	10
2	Internal Examination	15
3	Home Assignment	5

9.2.4 Laboratory Courses

For Laboratory courses, there shall be continuous evaluation during the semester for 25 marks and semester end evaluation for 50 marks. The distribution of marks for continuous internal evaluation is given in the Table 3:

Table 3: Distribution of Marks (CIE)

S. No.	Criterion	Marks
1	Day to Day Evaluation	10
2	Record	05
3	Internal Examination	10

9.2.5 Project Phase I

For Project Phase I, there shall be continuous internal evaluation during the semester for 100 marks. The continuous internal evaluation for the Project Phase I shall be on the basis of day to day assessment by the project guide and two reviews conducted by the Project Review Committee (PRC). The PRC consists of Head of the Department, Programme Coordinator, Senior Faculty member of the department and Project guide. The distribution of continuous internal evaluation marks is given in the Table 4:

Table 4: Distribution of Marks (CIE)

S. No.	Criterion	Marks
1	Day to Day Evaluation	40
2	Two Reviews	30+30

9.2.6 Project Phase II

For Project Phase II, there shall be continuous internal evaluation during the semester for 100 marks and semester end evaluation for 100 marks. The continuous internal evaluation for the Project Phase II shall be on the basis of day to day assessment by the project guide and two reviews conducted by the Project Review Committee (PRC). The PRC consists of Head of the Department, Programme Coordinator, Senior Faculty member of the departmentand Project guide. The distribution of marks is given in the Table 5:

Table 5: Distribution of Marks (CIE)

S. No.	Criterion	Marks
1	Day to Day Evaluation	40
2	Two Reviews	30+30

9.2.7 MOOCs Courses

Students who have qualified in the examination conducted by the MOOCs providers as specified in 7.2.2 are exempted from appearing in the continuous and semester end evaluations conducted by the institution.

In case, a student fails to complete the MOOCs course offered by MOOC's providers, he/she may be allowed to register again for the same with any of the providers from the list provided by the department or the student may be allowed to register for the course as and when offered by the college as supplementary candidate.

Students Registered and cleared the opted courses in MOOC's are exempted from appearing Semester end examinations conducted by the Institute.

The Scheme of Evaluation for MOOCs courses shall be scaled to continuous internal evaluation as 30 marks and semester end examination as 70 marks.

9.3 Semester End Examination

9.3.1 Theory Courses : 70 Marks

The Semester end examination shall be conducted with 3 hours duration at theend of the semester. The question paper shall be given in the following pattern:

a) **Part A:** Contains 5 questions of 2 marks each to test the knowledge level of the student. One question shall be given from each unit of the prescribed syllabus included in five units. The student shall answer all questions.

b) **Part B:** Contains 10 questions. Two questions from each unit shall be given with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus. The student shall answer one question from each unit.

The questions shall be framed in line with the Course Outcomes defined and cognitive levels.

9.3.2 Laboratory Courses: 50 marks

i. The Semester end examination for laboratory courses shall be conducted with three hour duration at the end of semester for 50 marks as given in the table 6:

Table 6: Distribution of Marks (SEE)

S. No.	Criterion	Marks
1	Procedure	10
2	Experiment/Programme Execution	20
3	Result	10
4	Viva-Voce	10

ii. Each Semester end Laboratory Examination shall be conducted by an External Examiner along with the Internal Examiner.

9.3.3 Project Phase II: 100 marks

The semester end examination for project phase II shall be held for 100 marks by a committee consisting of an external examiner, Head of the Department, Programme coordinator and Project guide. The evaluation of the project work shall be conducted at the end of the VIII Semester.

The average of the marks awarded by the committee members shall be taken into consideration in case of variation among the members.

The evaluation of 100 marks is distributed as given in Table 7:

Table 7: Distribution of Marks in Project Phase II

S. No.	Criterion	Marks
1	Report	40
2	Presentation	30
3	Viva –Voce	30

9.3.4 Internship/Industry Interaction: 75 Marks

a) Internships:

The candidate shall submit the comprehensive report to the department. The report will be evaluated for 75 marks by the Review Committee consisting of Head of the department, Programme Coordinator and Concerned Industry Representative/ Industry Institute Interaction Coordinator.

b) Industry Offered Courses:

The semester end examination for the courses under this category is evaluated for 75 marks and it shall be conducted and evaluated by the industry expert who has delivered the lecture or by the faculty nominated by the head of the department in consultation with the industry expert. The question paper pattern shall be decided by the industry expert at the beginning of the course and the same is to be approved by the Principal.

There will not be continuous internal evaluation for the courses under this category.

9.4 Conditions for Pass Marks

9.4.1 A candidate shall be declared to have passed in individual theory/drawing course if he/she secures a minimum of 40% aggregate marks (Continuous Internal Evaluation & Semester End Examination marks put together), subject to a minimum of 35% marks in semester end examination.

9.4.2 A candidate shall be declared to have passed in individual laboratory course/project if he/she secures a minimum of 50% aggregate marks (Continuous Internal Evaluation &Semester End Examination marks put

together), subject to a minimum of 40% marks in semester endexamination.

9.4.3 Mandatory Courses are assessed for PASS or FAIL only. No grade will be assigned to these courses. If a candidate secures more than 40 out of 100 marks,he / she will be declared PASS or else FAIL.

9.4.4 Mandatory courses NCC/NSS/NSO/YOGA are assessed for satisfactory or not satisfactory only. No grade will be assigned. A candidate has to undergo two hours training per week in any one of the above in both I and II semesters.

9.4.5 The student has to get pass marks in the failed course by appearing the supplementary examination as per the requirement for the award of degree.

9.4.6 The student shall earn assigned credits for the course on passing a course of a programme.

9.5 Revaluation

9.5.1 Continuous Internal Evaluation

The continuous Evaluation scripts shall be shown to the students before finalizing the marks. However, if the student has any concern, not addressed before the finalization of marks, he/she may submit the application for revaluation to the concerned head of the department.

The Head of the Department may constitute a two member committee for re-evaluating the script. The evaluation of the committee is final and binding.

9.5.2 Semester End Examination

1. As per the notification issued by the Controller of Examinations, the students can submit the applications for revaluation, along with the requisite fee receipt for revaluation of his/her answer script(s) of theory course(s), if he/she is not satisfied with the marks obtained.
2. The Controller of Examinations shall arrange for re-evaluation of those answer script(s).
3. A new external examiner, other than the first examiner, shall re-evaluate the answer script(s).
4. Revaluation marks will be taken into consideration only if the difference between the two valuations is more than or equal to 15%. Better marks between the two shall be taken into consideration. However, if the revaluation marks facilitates passing of the candidate, then the revaluation marks will be considered even if the difference of marks is less than 15%.
5. If the difference of marks between the two valuations is more than 20%, the answer script will be referred to third valuation. The average of nearest two marks will be awarded.

9.6 Withholding of Results

If the student has not paid the dues to the college, or if any case of malpractice or indiscipline is pending against him, the result of the student will be kept as withheld and he/she will not be allowed to enter the next semester. His/her degree shall be considered as withheld in such cases.

10 CRITERIA TO ATTEND SEMESTER END EXAMINATION AND PROMOTION TO HIGHER SEMESTER

10.1 Eligibility for Semester End Examinations

10.1.1 Students shall put in a minimum average attendance of 75% in the courses from category 7.2.1 to 7.2.6 put together, computed by totalling the number of periods of lectures, tutorials, drawing, practical and project work as the case may be, held in every courseas the denominator and the total number of periods

attended by the student in all the courses put together as the numerator, to be eligible to write semester end examinations.

10.1.2 Condonation of shortage in attendance may be recommended by respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance as calculated above and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student.

10.1.3 Students, having more than 65% and less than 75% of attendance, shall have to pay requisite fee towards condonation.

10.2 Conditions for Promotion

10.2.1 A student shall be eligible for promotion to next Semester of B.Tech. Programme, if he/she satisfies the conditions as stipulated inRegulations **10.1.**

10.2.2 Further, a student shall be eligible for promotion to V / VII Semesterof B.Tech. Programme, if he/she completes the academic requirements of 50% of the credits upto IV/ VI semesters.

10.2.3 Promotion to V Semester

For Four Year B.Tech. Course candidates

A four year programme student shall be promoted from IV semester to V semester only if he/she earns 50% credits of the designed programme credits from I semester to IV semester.

10.2.4 Promotion to VII Semester

i) For Four Year B.Tech Course candidates

A four year programme student shall be promoted from VI semester to VII semester only if he/she earns 50% credits of the designed programme credits from I semester to VI semester.

ii) For Lateral Entry candidates

A lateral entry student shall be promoted from VI semester to VII semester only if he/she earns 50% credits of the designed programme credits from III semester to VI semester.

10.2.5 For Detained Students

a) Students who are already detained for want of credits shall be promoted to **V Semester** if he/she fulfills the 50 % of the credit requirements from all the regular and supplementary examinations held upto IV Semester till the commencement of next academic year.

b) Students who are already detained for want of credits shall be promoted to **VII Semester** if he/she fulfills the 50 % of the credit requirements from all the regular and supplementary examinations held upto VI Semester till the commencement of next academic year.

11. SUPPLEMENTARY EXAMINATIONS

11.1 General

Semester end Supplementary examinations shall be conducted alongwith regular semester end examinations.

11.2 Advanced Supplementary Exams

Candidate(s), who fails in Theory or Laboratory courses of VIII semester, can appear for advanced supplementary examination conducted within one month after declaration of the revaluation results. However, those candidates who fail in the advanced supplementary examinations of VIII semester shall appear for subsequent examinations along with regular candidates conducted at the end of the respective academic year.

12. READMISSION CRITERIA

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

Rules for calculation of attendance for readmitted students

a) Number of classes conducted shall be counted from the commencement day of the semester concerned, irrespective of the date of payment of tuition fee.
b) They shall submit a written request to the principal of the college, along with a challan paid towards tuition and other fee, for readmission before the commencement of the class work.
c) They can get the information regarding date of commencement of class work for each semester that will be made available in the college notice boards/website from time to time.

13. BREAK IN STUDY

Student, who discontinues the studies for valid reason permitted by the principal, shall get readmission into appropriate semester of B.Tech. programme after break-in study, with the prior permission of the Principal and following the transitory regulations applicable to such batch in which he/she joins. An administrative fee of **Rs**. 1**000/-**per each year of break in study, in addition to the prescribed tuition and special fee has to be paid by the candidate to condone his/her break in study.

14. TRANSITORY REGULATIONS

A candidate, who is detained or discontinued in a semester, on re-admission, the academic regulations under which he/she has originally admitted will continue to be applicable to him/her on re-admission.

15. ELIGIBILITY FOR AWARD OF B.TECH. DEGREE

15.1 The B.Tech. Degree shall be conferred on a candidate who satisfies the following requirements.

15.1.1 A Regular student (four year programme) shall register and secure himself/herself for **160** Credits from the categories 7.2.1 to 7.2.6

15.1.2 A Lateral Entry student (three year programme) shall register and secure himself/herself for **121.5** credits from the categories 7.2.1 to7.2.6

15.2 Award of Division

The criteria for award of division, after successful completion of programme isas shown in Table 8:

Table 8: Criteria for Award of Division

CGPA	DIVISION
≥ 7.5	First Class with distinction*
≥ 6.5 - < 7.5	First Class
≥ 5.5 - < 6.5	Second Class
≥ 5.0 - < 5.5	Pass Class
< 5.0	Fail

* Awarded only if all the courses prescribed are cleared in single attempt within four years for regular candidates and three years for lateral entry candidates
* Detained and break-in study candidates are not eligible for the award of First Class with Distinction
* The cases of students who are absent for semester end examination only once in his/her duration of B.Tech. programme on valid medical grounds/humanitarian grounds shall also be considered for the award of First class with Distinction subject to the recommendations of the committee constituted by the Principal.
* For the purpose of awarding First, Second and Pass Class CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the programme shall be considered.

15.3 Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the students will be issued after successful completion of the four year B.Tech Programme.

16. CONDUCT AND DISCIPLINE

16.1 Students shall conduct themselves within and outside the premises of the Institute in a manner befitting the students of our Institution.

16.2 As per the order of Honourable Supreme Court of India and AICTE guidelines, ragging in any form is considered a criminal offence and is banned. Ragging within or outside any educational institution is prohibited. Ragging means doing an act, that causes or is likely to cause insult or annoyance or fear of apprehension or threat or intimidation or outrage of modesty or injury to a student. Any form of ragging will be severely dealt with as per AP Prohibition of Ragging Act-1997 section-4.

Table – 9: Punishments for Ragging

Nature of ragging	Punishment
Teasing, embarrassing and humiliating	Imprisonment upto 6 months or fine upto Rs.1,000/- or both
Assaulting or using criminal force or criminal intimidation	Imprisonment upto 1 year or fine upto Rs.2,000/- or both
Wrongfully restraining or confining or causing hurt	Imprisonment upto 2 years or fine upto Rs.5,000/- or both
Causing grievous hurt kidnapping or raping or committing unnatural offence	Imprisonment upto 5 years and fine upto Rs.10,000/-
Causing death or abetting suicide	Imprisonment upto 10 years and fine upto Rs.50,000/-

16.3 A student who is convicted of an offence and punished with imprisonment for a term of more than six months shall not be admitted into the institution.

16.4 Whenever any student complains of ragging to the head or manager of an educational institution, such head or manager should inquire into the complaint and if the complaint is prima-facie found true, should suspend the student or students complained against.

16.5 If the head or manager of an educational institution fails or neglects to take action in the manner specified in the Act, the person shall be deemed to have abetted the offence and shall be punished with the punishment provided for

the offence.

16.6 If a student commits suicide due to or in consequence of ragging, the person who commits such ragging shall be deemed to have abetted such suicide.

The following acts of omission and/or commission shall constitute gross violationof the code of conduct and are liable to invoke disciplinary measures.

i. Lack of courtesy and decorum; indecent behaviour anywhere within or outsidethe campus.
ii. Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

The following activities are not allowed within the campus:

- Mutilation or unauthorized possession of library books.
- Noisy and unseemly behaviour, disturbing studies of fellow students.
- Hacking computer systems (such as entering into other person's areas without prior permission, manipulation and/or damage of computer hardware and software or any other cybercrime etc.)
- Use of mobile phones.
- Plagiarism of any nature.
- Any other act of gross indiscipline as decided by the Institute from time to time.
- Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute/ hostel, debarment from a examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.
- For an offence committed in (i) a hostel, (ii) a department or in a class room and (iii) elsewhere, the Chief Warden, the Head of the Department and the Principal, respectively, shall have the authority to reprimand or impose fine.
- Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Principal for taking appropriate action.
- Unauthorized collection of money in any form is strictly prohibited.
- Detained and break-in-study candidates are allowed into the campus for academic purposes only with the permission from authorities.
- Misconduct committed by a student outside the Institute campus but having the effect of damaging, undermining & tarnishing the image & reputation of the institution will make the student concerned liable for disciplinary action commensurate with the nature and gravity of such misconduct.
- The disciplinary action committee constituted by the Principal, shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.
- Grievance redressal committee, constituted by the Principal, shall deal with all grievances pertaining to the academic/ administrative and disciplinary matters.
- All the students must abide by the code and conduct rules of the Institute.

17 MALPRACTICES

The Principal shall refer the cases of malpractices by students in internal assessment tests and end semester examinations, to a malpractice enquiry committee constituted for the purpose. The committee shall follow the approved scales of punishment.

The committee consists of:

1. Heads of Department (Three)
2. Controller of Examinations
3. Deputy Controller of Examinations

Table – 10: Disciplinary action for malpractices/improper conduct in examinations

S.No.	Nature of Malpractices/Improper conduct	Punishment
1 (a)	If the candidate possesses or keeps accessible, any paper, note book, programmable calculators, mobile phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in the examination hall but has not made use of (material shall include any marks on the student's body that 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)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through mobile 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	If the candidate 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. He 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.
3	If the candidate 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 for feiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the candidate smuggles in an 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 other examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with for feiture of seat.
5	If the candidate 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	If the candidate 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 results in damage to or destruction of	In case of students of the Institute, 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.

	property in the examination hall or any part of the Institute campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7	If the candidate leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all other examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	If the candidate possesses 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 Institute, who is not a candidate for the particular examination or any person not connected with the Institute indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the Institute: 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. He 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 Institute: Will be handed over to police and a police case will be registered against them.
10	If the candidate 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. He 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 awarded suitable punishment.	

However, they shall appear for Semester End Examinations as per theAcademic Calendar

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

19 GENERAL

1 Wherever the words "he", "him", "his", occur in the regulations, they may include"she", "her", "hers".
2 The academic regulations should be read as a whole for the purpose of any interpretation.
3 In case of any doubt or ambiguity in the interpretation of above rules, the decisionof the principal is final.

20 INSTITUTE RULES AND REGULATIONS

1 Use of **Mobile phones** is strictly prohibited inside the Institute academic area.
2 Students should come to Institute in **proper dress**.
3 All students should wear **identity cards** in the Institute premises.
4 Students should be present in their respective classrooms **before the commencement of class sharply**.
5 Students should not leave the Institute premises without prior permission of their respective Heads of the departments during Institute working hours.
6 Students should maintain silence in the class rooms during working periods.
7 Sitting / wandering of the students at the stair cases, corridors, cycle stands or theareas within the Institute premises is strictly prohibited.
8 Usage of Vehicle horn inside the Institute premises is prohibited.

21 AMENDMENTS TO REGULATIONS

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

Oratory
PRINCIPAL

PVP 19

B.Tech. COURSE STRUCTURE

PVP 19

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech. under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

I B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1101	Communicative English I	2	0	0	2	30	70	100
19BS1101	Engineering Mathematics I (Calculus and Algebra)	3	0	0	3	30	70	100
19BS1104	Engineering Physics	3	0	0	3	30	70	100
19ES1101	Basic Electrical and Electronics Engineering	3	1	0	4	30	70	100
19ES1103	Engineering Graphics	1	0	3	2.5	30	70	100
19HS1151	Communicative English I Lab	0	0	3	1.5	25	50	75
19BS1153	Engineering Physics Lab	0	0	3	1.5	25	50	75
19ES1151	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	25	50	75
19MC1151	NCC/NSS/YOGA/Activity Clubs	0	0	2	0	100		100
	Total	12	1	14	19	325	500	825

I B.TECH - II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1201	Communicative English II	2	0	0	2	30	70	100
19BS1201	Engineering Mathematics II (ODE, PDE and Multivariable Calculus)	3	0	0	3	30	70	100
19BS1203	Engineering Chemistry	3	0	0	3	30	70	100
19ES1202	Problem Solving and Programming	3	1	0	4	30	70	100
19HS1251	Communicative English II Lab	0	0	3	1.5	25	50	75
19BS1251	Engineering Chemistry Lab	0	0	3	1.5	25	50	75
19ES1252	Problem Solving and Programming Lab	0	0	3	1.5	25	50	75
19ES1253	Basic Workshop	0	0	3	1.5	25	50	75
19EC3251	Electronics Workshop	0	0	3	1.5	25	50	75
19MC1251	NCC/NSS/YOGA/Activity Clubs	0	0	2	0	100		100
	Total	11	1	17	19.5	345	530	875

PVP 19

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech. under PVP19 regulations
(Effective from Academic Year 2019-20)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

II B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19BS1301	Engineering Mathematics III (PDE, Complex Variables and Transform Techniques)	3	0	0	3	30	70	100
19ES1301	AI Tools	2	0	0	2	30	70	100
19ES1302	Design Thinking & Product Innovation	2	0	0	2	30	70	100
19EC3301	Network Theory&Analysis	3	0	0	3	30	70	100
19EC3302	Electronic Devices and Amplifier Circuits	3	0	0	3	30	70	100
19EC3303	Signals and Systems	3	0	0	3	30	70	100
19MC1302	Constitution of India	3	0	0	0	100		100
19ES1351	AI Tools Lab	0	0	2	1	25	50	75
19ES1352	Design Thinking & Product Innovation Lab	0	0	2	1	25	50	75
19EC3351	Network Theory and Analysis Lab	0	0	2	1	25	50	75
19EC3352	Electronic Devices and Amplifier Circuits Lab	0	0	3	1.5	25	50	75
	Total	19	0	9	20.5	380	620	1000

II B.TECH - II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19BS1402	Engineering Mathematics IV (Probability Theory and Random Processes)	3	0	0	3	30	70	100
19BS1404	Life Sciences for Engineers	2	0	0	2	30	70	100
19EC3401	Digital Logic Design	3	0	0	3	30	70	100
19EC3402	Electromagnetic Waves	3	0	0	3	30	70	100
19EC3403	Analog Circuits	3	0	0	3	30	70	100
19EC3404	Analog Communications	3	0	0	3	30	70	100
19MC1401	Environmental Sciences	3	0	0	0	100		100
19BS1451	Life Sciences for Engineers Lab	0	0	2	1	25	50	75
19EC3451	Digital Logic Design Lab	0	0	3	1.5	25	50	75
19EC3452	Analog Circuits Lab	0	0	3	1.5	25	50	75
19EC3453	Analog Communications Lab	0	0	3	1.5	25	50	75
	Total	20	0	11	22.5	380	620	1000

Prasad V. Potluri Siddhartha Institute of Technology
Course Structure for B. Tech under PVP19 regulations
(Effective from Academic Year 2019-20)
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
III B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19ES1501	Internet of Things	2	0	0	2	30	70	100
19EC3501	Antenna Analysis and Synthesis	3	0	0	3	30	70	100
19EC4501	Program Elective-I	3	0	0	3	30	70	100
19EC3502	Digital Signal Processing	3	0	0	3	30	70	100
19EC3503	Control Systems Engineering	3	0	0	3	30	70	100
	Interdisciplinary Elective I	3	0	0	3	30	70	100
	Open Elective I	3	0	0	3	30	70	100
19ES1552	Internet of Things Lab	0	0	2	1	25	50	75
19EC3551	Antenna Analysis and Synthesis Lab	0	0	2	1	25	50	75
19EC3552	Digital Signal Processing Lab	0	0	3	1.5	25	50	75
Total		20	0	7	23.5	285	640	925

Programme Elective-I

S.No	**Stream**	Course code	Name of the subject	L	T	P	Credits
1	Communication Engineering	19EC4501A	Digital Communications	3	0	0	3
2	Signal Processing	19EC4501B	DSP Processors and Architectures	3	0	0	3
3	VLSI Design	19EC4501C	Digital System Design	3	0	0	3
4	Microwaves	19EC4501D	Transmission lines and Waveguides	3	0	0	3
5	Embedded Systems	19EC4501E	Computer Organization and Design	3	0	0	3
6	Sensors & IoT	19EC4501F	Wireless Sensor Networks and IoT	3	0	0	3

Inter Disciplinary Elective-I

S.No.	Course code	Name of the subject	L	T	P	Credits
1	19CS2501A	Database Management Systems	3	0	0	3
2	19HS2501A	Quantitative Techniques for Management	3	0	0	3
3	19IT2501A	OOP with C++	3	0	0	3
4	19ME2501A	Computational Methods	3	0	0	3

OPEN ELECTIVE-I

S.No	Course Type	Course code	Name of the subject	L	T	P	Credits
1	OE-I	19ES5501A	Biotechnology and Society	3	0	0	3
2	OE-I	19ES5501B	Electrical Safety	3	0	0	3
3	OE-I	19ES5501C	Fundamentals of Cyber Law	3	0	0	3
4	OE-I	19ES5501D	Environment and Ecology	3	0	0	3
5	OE-I	19HS5501A	Contemporary Relevance of Indian Epics	3	0	0	3
6	OE-I	19HS5501B	Indian National Movement	3	0	0	3
7	OE-I	19HS5501C	Engineering for Community Service	3	0	0	3
8	OE-I	19HS5501D	Personality Development	3	0	0	3
9	OE-I	19HS5501E	Introduction to International Business	3	0	0	3
10	OE-I	19HS5501F	Gandhian Philosophy	3	0	0	3
11	OE-I	19HS5501G	Indian History	3	0	0	3

III B. TECH – II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1601	Engineering Economics and Management	3	0	0	3	30	70	100
19EC3601	Microprocessors and Microcontrollers	3	0	0	3	30	70	100
19EC4601	Program Elective-II	3	0	0	3	30	70	100
19EC3602	Introduction to VLSI Design	3	0	0	3	30	70	100
19EC4602	Program Elective-III	3	0	0	3	30	70	100
19MC1601	Engineering Ethics	3	0	0	0	100		100
	Open Elective II	3	0	0	3	30	70	100
19EC3651	Microprocessors and Microcontrollers Lab	0	0	3	1.5	25	50	75
19EC3652	VLSI Design Lab	0	0	3	1.5	25	50	75
19EC3653	Design Practice	0	0	2	1	25	50	75
	Total	21	0	8	22	355	570	925

Programme Elective-II

S.No.	Stream	Course code	Name of the subject	L	T	P	Credits
1	Communication Engineering	19EC4601A	Wireless Communications Networks	3	0	0	3
2	Signal Processing	19EC4601B	Real Time Signal Processing	3	0	0	3
3	VLSI Design	19EC4601C	DSP Design with FPGAs	3	0	0	3
4	Microwaves	19EC4601D	Microwave Engineering	3	0	0	3
5	Embedded Systems	19EC4601E	ARM System Development	3	0	0	3
6	Sensors &IoT	19EC4601F	RFID Enabled Sensors and Applications	3	0	0	3

Programme Elective-III

S.No.	Stream	Course code	Name of the subject	L	T	P	Credits
1	Communication Engineering	19EC4602A	Fiber Optic Communications	3	0	0	3
2	Signal Processing	19EC4602B	Digital Image Processing	3	0	0	3
3	VLSI Design	19EC4602C	ASIC Design	3	0	0	3
4	Microwaves	19EC4602D	RF Circuit Design	3	0	0	3
5	Embedded Systems	19EC4602E	Software Defined Radio	3	0	0	3
6	Sensors & IoT	19EC4602F	Fiber Optic Sensors and Applications	3	0	0	3

OPEN ELECTIVE-II

S.No	Course Type	Course code	Name of the subject	L	T	P	Credits
1	OE-II	19ES5601A	Environmental Management	3	0	0	3
2	OE-II	19ES5601B	Telecommunication for Society	3	0	0	3
3	OE-II	19HS5601A	German for Beginners	3	0	0	3
4	OE-II	19HS5601C	Analytical Essay Writing	3	0	0	3
5	OE-II	19HS5601D	Indian Economy	3	0	0	3
6	OE-II	19HS5601E	Public Administration	3	0	0	3
7	OE-II	19HS5601F	National Service Scheme	3	0	0	3
8	OE-II	19HS5601G	Professional Communication	3	0	0	3
9	OE-II	19HS5601H	Basics of Finance	3	0	0	3
10	OE-II	19HS5601I	Basics of Marketing	3	0	0	3

PVP 19

Prasad V. Potluri Siddhartha Institute of Technology
Course Structure for B. Tech under PVP19 regulations
(Effective from Academic Year 2019-20)
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
IV B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1701	Organization Behaviour	3	0	0	3	30	70	100
19EC3701	Communication Networks	3	0	0	3	30	70	100
19EC4701	Program Elective-IV	3	0	0	3	30	70	100
19EC4702	Program Elective-V	3	0	0	3	30	70	100
	Interdisciplinary Elective II	3	0	0	3	30	70	100
19EC3751	Communication Networks Lab	0	0	2	1	25	50	75
19EC3761	Project Phase-I	0	0	4	2	100		100
19EC3771	Industrial Training/ Internship/ Research Projects in National Laboratories/ Academic Institutions				2	75		75
Total		15	0	6	20	350	400	750

Programme Elective-IV

S.No	Stream	Course code	Name of the subject	L	T	P	Credits
1	Communication Engineering	19EC4701A	Satellite Communications	3	0	0	3
2	Signal Processing	19EC4701B	Digital Signal Compression	3	0	0	3
3	VLSI Design	19EC4701C	Digital Integrated Circuits Design	3	0	0	3
4	Microwaves	19EC4701D	Microwave Antennas	3	0	0	3
5	Embedded Systems	19EC4701E	IoT Architecture	3	0	0	3
6	Sensors & IoT	19EC4701F	Sensors and Transducers for Remote Applications	3	0	0	3

Programme Elective-V

S.No	Stream	Course code	Name of the subject	L	T	P	Credits
1	Communication Engineering	19EC4702A	Global Positioning Systems	3	0	0	3
2	Signal Processing	19EC4702B	Biomedical Signal Processing	3	0	0	3
3	VLSI Design	19EC4702C	Analog IC Design	3	0	0	3
4	Microwaves	19EC4702D	Radar Systems	3	0	0	3
5	Embedded Systems	19EC4702E	TV Technology	3	0	0	3
6	Sensors &IoT	19EC4702F	IoT in Health Care	3	0	0	3

Inter Disciplinary Elective-II

S.No.	Course code	Name of the subject	L	T	P	Credits
1	19EE2701A	Renewable Energy Resources	3	0	0	3
2	19IT2701A	Web Technologies	3	0	0	3
3	19ME2701A	Optimization Techniques	3	0	0	3
4	19ME2701B	Project Management &Optimization	3	0	0	3

IV B. TECH – II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19EC4801	Program Elective-VI	3	0	0	3	30	70	100
	Inter Disciplinary Elective III	3	0	0	3	30	70	100
19EC3861	Project Phase-II	0	0	14	7	100	100	200
Total		6	0	14	13	160	240	400

Programme Elective-VI

S.No.	Stream	Course code	Name of the subject	L	T	P	Credits
1	Communication Engineering	19EC4801A	Cellular and Mobile Communications	3	0	0	3
2	Signal Processing	19EC4801B	Speech Processing	3	0	0	3
3	VLSI Design	19EC4801C	Fundamentals of Semiconductor Devices	3	0	0	3
4	Microwaves	19EC4801D	EMI and EMC Techniques	3	0	0	3
5	Embedded Systems	19EC4801E	Embedded Systems	3	0	0	3
6	Sensors &IoT	19EC4801F	MEMS and Nano sensors	3	0	0	3

Inter Disciplinary Elective-III

S.No.	Course code	Name of the subject	L	T	P	Credits
1	19CS2801A	Introduction to Python Programming	3	0	0	3
2	19EC2801A	Instrumentation and Sensor Technologies of Civil Engineering Applications	3	0	0	3
3	19HS2801A	Logistics and Supply Chain Management	3	0	0	3
4	19ME2801A	Total Quality Management	3	0	0	3

PVP 19

I YEAR

COMMUNICATIVE ENGLISH - 1

Course Code	19HS1101	Year	I	Semester	I
Course Category	Humanities	Branch	ECE	Course Type	Theory
Credits	2	L-T-P	2-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Comprehend how to apply parts of speech in a sentence and construct a paragraph.
CO2	Apply grammar to formulate text using punctuation.
CO3	Evaluate reading texts and use correct tense forms for effective communication.
CO4	Analyze reading texts and to write summaries based on comprehension of the texts.
CO5	Create awareness on how to write correct sentences in English and comprehend the text.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1										3		3	
CO2										3		3	
CO3										3		3	
CO4										3		3	
CO5										3		3	
Average* (Rounded to nearest integer)										3		3	

Syllabus

Unit No.	Contents	Mapped CO
I	**Reading:** Skimming to get the main idea of a text; Scanning to look for specific pieces of information. **Reading for Writing:** Beginnings and endings of paragraphs - Introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; Word forms: Verbs, Nouns, Adjectives and Adverbs; Nouns: countables and uncountables; singular and plural; Basic sentence structures; Simple question form – wh - questions; Word order in sentences.	CO1
II	**Reading:** Identifying sequence of ideas; recognizing verbal techniques thathelp to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices;Mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; Use of articles and zero article; prepositions	CO2
III	**Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to	CO3

	use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - Tenses; Subject-verb agreement; Direct and indirect speech, Reporting verbs for academic purposes.	
IV	**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processesor display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Degrees of comparison; Use ofantonyms	CO4
V	**Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences **Grammar and Vocabulary:** Editing short texts – Identifying and correcting common errors in grammar and usage (Articles, prepositions,Tenses, Subject-verb agreement)	CO5

Learning Resources
Text Books
Prabhavathy Y, M.Lalitha Sridevi, Ruth Z. Hauzel, "English all round communication skills for undergraduate students", Orient Black Swan, 2019
Reference Books
1.Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014. 2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 3. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012
e- Resources & other digital material
Grammar/Listening/Writing 1-language.com; http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online; http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/; http://www.nonstopenglish.com/ https://www.vocabulary.com/; BBC Vocabulary Games Free Rice Vocabulary GameReading https://www.usingenglish.com/comprehension/; https://www.englishclub.com/reading/short-stories.htm; https://www.english-online.at/All Skills https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ Online Dictionaries Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

PVP 19

ENGINEERING MATHEMATICS – 1
(CALCULUS AND ALGEBRA)

Course Code	19BS1101	**Year**	I	**Semester**	I
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	utilize the techniques of matrix algebra that is needed by engineers for practical applications
CO2	apply mean value theorems to engineering problems
CO3	utilize functions of several variables in optimization
CO4	employ the tools of calculus for calculating the areas
CO5	calculate volumes using multiple integrals

Contribution of Course Outcomes towards achievement of Program Outcomes &Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											1	
CO2	3	2											1	
CO3	3	2											1	
CO4	3	2											1	
CO5	3	2											1	
Average* (Rounded to nearest integer)	3	2											1	

Syllabus

Unit No.	Contents	Mapped CO
I	Matrices: Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous linear equations. Eigen values, Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.	CO1
II	Mean Value Theorems: Rolle‘s Theorem, Lagrange‘s mean value theorem, Cauchy‘s mean value theorem, Taylor‘s and Maclaurin‘s theorems with remainders (without proof).	CO2
III	Multivariable Calculus: Partial derivatives, total derivatives, chain rule, change of variables, Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers.	CO3
IV	Multiple Integrals-I: Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.	CO4

V	Multiple Integrals-II: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volume as triple integral.	CO5

Learning Resources
Text Books
1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017 2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018
Reference Books
1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, AlphaScience International Ltd., 2002. 2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, PearsonPublishers, 2013. 3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers,2011.
e- Resources & other digital material
1. www.nptelvideos.com/mathematics/ 2. https://nptel.ac.in/courses/111104025/ 3. https://nptel.ac.in/courses/122101003/

PVP 19

ENGINEERING PHYSICS

Course Code	19BS1104	**Year**	I	**Semester**	I
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	To familiarize the basic DC and AC networks used in electrical and electronic circuits.
CO2	To explain the concepts of electrical machines and their characteristics.
CO3	To identify the importance of transformers in transmission and distribution of electric power.
CO4	To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
CO5	To expose basic concepts and applications of Operational Amplifier and configurations.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3											2	
CO2	3	3											3	
CO3	3	3											2	
CO4	3	3											2	
CO5	3	3											3	
Average* (Rounded to nearest integer)	3	3											3	

Syllabus

Unit No	Contents	Mapped co
I	**Basics of Electromagnetics** Electrostatic field: Coulombs law and Gauss law, derivation of Coulombs law from Gauss law, applications of Gauss law (line charge, thin sheet of charge and solid charged sphere), Gauss law of electrostatics in dielectric medium, divergence and curl of electric fields, electric potential, relation between potential and force, Poisson's and Laplace equations. Magneto static field: Biot–Savart law, divergence and curl of magnetic fields, Faraday's and Ampere's laws in integral and differential form, displacement current, continuity equation, Maxwell's equations	**CO1**
II	**Fiber Optics** Introduction, advantages of optical fibers, principle and structure, acceptance angle, numerical aperture, modes of propagation, classification of fibers, fiber optic communication, importance of V- number, fiber optic sensors (Temperature, displacement and force), applications.	CO2

III	**Dielectric and Magnetic materials** Dielectric materials: Introduction, electric polarization, dielectric polarizability, susceptibility and dielectric constant, types of polarizations (qualitative treatment only), frequency dependence of polarization, Lorentz (internal) field (quantitative), Clausius - Mossotti equation. Magnetic materials: Introduction, magnetic dipole moment, magnetization, magnetic susceptibility and permeability, origin of permanent magnetic moment, classification of magnetic materials, Weiss theory of ferromagnetism (qualitative), domain theory, hysteresis, soft and hard magnetic materials.	CO3
IV	**Semiconductor physics** Introduction, origin of energy band, intrinsic and extrinsic semiconductors, mechanism of conduction in intrinsic semiconductors, generation and recombination, carrier concentration in intrinsic semiconductors, variation of intrinsic carrier concentration with temperature, n-type and p-type semiconductors, carrier concentration in n type and p type semiconductors.	CO4
V	**Semiconductor devices** Drift and diffusion currents in semiconductors, Hall effect and its applications, magneto resistance, p-n junction layer formation and V-I characteristics, direct and indirect band gap semiconductors, construction and working of photodiode, LED, solar cell	CO5

Learning Resources
Text Books
1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited, 2017. 2. B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1st edition, S.Chand Publishing, New Delhi, 2006. 3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.
Reference Books
1. S.K.Bhattacharya, Basic Electrical and Electronics Engineering, PearsonEducation, 2011. 2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2nd edition, PearsonEducation, 2008. 3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.
e- Resources & other digital material
http://202.53.81.118/course/view.php?id=122 https://nptel.ac.in/courses/108105112/

PVP 19

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course Code	19ES1101	**Year**	I	**Semester**	I
Course Category	Engineering Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	4	**L-T-P**	3-1-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	To familiarize the basic DC and AC networks used in electrical and electronic circuits.
CO2	To explain the concepts of electrical machines and their characteristics.
CO3	To identify the importance of transformers in transmission and distribution of electric power.
CO4	To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
CO5	To expose basic concepts and applications of Operational Amplifier and configurations.

Contribution of Course Outcomes towards achievement of Program Outcomes &
Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					1		1		2	1	2	
CO2	3	2				1	1		1		2	1		
CO3	3	2				1	1		1		2	1		
CO4	3	2					1		1		2	1	2	2
CO5	3	2					1		1		2	1	2	2
Average* (Rounded to nearest integer)	3	2				1	1		1		2	1	2	2

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	Basic laws and Theorems: Ohms law, Kirchoff's Laws, series andparallel circuits, source transformations, delta-wye conversion. Mesh analysis, nodal analysis. Linearity and superposition theorem, Thevenin's and Norton's theorem with simple examples, maximumpower transfer theorem with simple examples.	CO1
II	DC Machines: Constructional features, induced EMF and torque expressions, different types of excitation, performance characteristics of different types of dc machines, Starters: 2-point, 3-point starters, losses and efficiency, efficiency by direct loading.	CO2
III	Transformers: Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short- circuit tests and determination	CO3

	of efficiency. Three Phase Induction Motors: Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.	
IV	Semiconductor Devices: p-n Junction diode - Basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.	CO4
V	Operational Amplifiers: The Ideal Op Amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Non-inverting Configuration, The closed loop gain, Characteristics of Non Inverting Configuration, Effect of finite open loop gain, the voltage follower, Difference amplifiers, A Single Op-amp difference amplifier.	CO5

Learning Resources
Text Books
1. D. P. Kothari, I. J. Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited, 2017. 2. B. L. Theraja, Fundamentals of Electrical Engineering and Electronics, 1st edition, S. Chand Publishing, New Delhi, 2006. 3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.
Reference Books
1. S.K.Bhattacharya, BasicElectrical and Electronics Engineering, Pearson Education, 2011. 2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, PearsonEducation, 2008. 3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press,New Delhi, 2012.
e- Resources & other digital material
http://202.53.81.118/course/view.php?id=122 https://nptel.ac.in/courses/108105112/

PVP 19

ENGINEERING GRAPHICS

Course Code	19ES1103	**Year**	I	**Semester**	I
Course Category	Engineering Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	2.5	**L-T-P**	1-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Conic sections and curves used in engineering practice.
CO2	Orthographic projections of points, lines, planes and solids.
CO3	Isometric and orthographic views.
CO4	Development of lateral surfaces of solids.
CO5	Features of CAD packages.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3									3	1		1	
CO2	3									3	1		1	
CO3	3									3	1		1	
CO4	3									3	1		1	
CO5	3				3					3	1		3	
Average* (Rounded to nearest integer)	3				3					3	1		2	

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Engineering Graphics:** Principles of Engineering Graphics and their significance- Conventions in drawing, lettering, dimensioning, BIS conventions. **Conic sections:** Construction of ellipse, parabola and hyperbola (general method only) **Cycloidal curves:** Cycloid, Epicycloid and Hypocycloid **Involutes:** Involute of regular polygons and Circle.	CO1
II	**Projection of points, lines and planes:** Projection of points in different quadrants, lines inclined to one and both the reference planes, finding true length and inclination made by the line. Projections of regular plane surfaces.	CO2
III	**Projections of solids:** Projections of regular solids such as cube, cylinder and cone (Treatment limited to solids inclined to one of the Sections of solids: Section planes and sectional view of right regular solids- cube, prism, cylinder, pyramid and cone. True shape of the section. (Treatment limited to the solids perpendicular to one of the principal planes)	CO3

IV	**Orthographic Views:** Systems of projections, conversion of isometric view to orthographic view. **Isometric Projections:** Principles of isometric projection- isometric scale; isometric views: lines, planes and solids. (Treatment is limited to simple objects only)	CO4
V	**Development of surfaces:** Development of lateral surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts. (Treatment limited to solids perpendicular to one of the principal planes)	CO5
	Introduction to CAD: Basic drawing, editing and dimensioning commands: line, circle, rectangle, erase, view, undo, redo, snap, edit, move, copy, rotate, scale, mirror, layer, template, polyline, trim, extend, stretch, fillet, array, dimension.	

Learning Resources
Text Books
1. N.D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016. 2. K.L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, 2012.
Reference Books
1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, 2009. 2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009. 3. K. Venugopal, Engineering Drawing and Graphics, 6/e, New Age Publishers, 2011. 4. K.C. John, Engineering Graphics, 2/e, PHI, 2013. 5. Basant Agarwal and C.M. Agarwal, Engineering Drawing, Tata McGraw Hill, 2008.
e- Resources & other digital material
1. http://www.youtube.com/watch?v=XCWJ XrkWco, Accessed On 01-06-2017. 2. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html# iso drawing, Accessed On 01-06-2017. 3. http://www.slideshare.net, Accessed On 01-06-2017. 4. http://edpstuff.blogspot.in, Accessed On 01-06-2017.

PVP 19

COMMUNICATIVE ENGLISH – 1 LAB

Course Code	19HS1151	**Year**	I	**Semester**	I
Course Category	Humanities	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation:	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
CO2	Apply communication skills through various language learning activities
CO3	Analyze the comprehensive ability and logical thinking for better listening and speaking.
CO4	Evaluate and exhibit acceptable etiquette essential in social and professional situations.
CO5	Create awareness on how to improve presentation skills in English.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									2	3		3	1	
CO2									2	3		3	1	
CO3									2	3		3	1	
CO4									2	3		3	1	
CO5									2	3		3	1	
Average* (Rounded to nearest integer)									2	3		3	1	

Syllabus

Expt. No.	Contents	Mapped CO
I	Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.	CO1
II	Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.	
III	Answering a series of questions about main idea and supporting ideas after listening to audio texts.	CO2
IV	Discussion in pairs/ small groups on specific topics followed by short structured talks.	
V	Listening for global comprehension and summarizing what is listened to.	CO3
VI	Discussing specific topics in pairs or small groups and reporting what is discussed	
VII	Making predictions while listening to conversations/ transactional dialogues without video; listening with video.	CO4

VIII	Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.	
IX	Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.	CO5
X	Formal oral presentations on topics from academic contexts - without the use of PPT slides.	

Learning Resources
Reference Books
1. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018. 2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 3. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012
e- Resources & other digital material
Grammar/Listening/Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Listening https://learningenglish.voanews.com/z/3613; http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/BBC; Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises All Skills https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ Online Dictionaries Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

PVP 19

ENGINEERING PHYSICS LAB

Course Code	19BS1153	**Year**	I	**Semester**	I
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Assess the intensity of the magnetic field of circular coil carrying current with varying distance and utilize four probe set up to measure resistance.
CO2	Evaluate the acceptance angle of an optical fiber and numerical aperture and loss.
CO3	Demonstrate the importance of dielectric material and measure magnetic parameters.
CO4	Identify the type of semiconductor using hall effect and determine the band gap of a semiconductor.
CO5	Understand the characteristics of photodiode, p-n junction diode and solar cell. Type equation here.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3										1	
CO2	3		3										3	
CO3	3		3										3	
CO4	3		3										3	
CO5	3		3										3	
Average* (Rounded to nearest integer)	3		3										3	

Syllabus

Expt. No.	Contents	Mapped CO
I	To Determine The Magnetic Field Along The Axis Of A Circular Coil Carrying Current	CO1
II	To Determine The Magnetic Susceptibility By Gouy's Method	
III	To Determine The Numerical Aperture Of A Given Optical Fibre And Hence To Find Its Acceptance Angle	CO2
IV	To Determine The Dielectric Constant Of A Substance By Resonance Method	CO3
V	To Determine The Resistivity Of Semiconductor By Four Probe Method	CO4
VI	To Determine The Hall Coefficient Using Hall Effect Experiment.	
VII	To Determine The Energy Gap Of A Semiconductor	
VIII	To Study The Characteristics Of Photo Diode	CO5
IX	To Study The Characteristics Of PN Diode	
X	To Study The Characteristics Of Solar Cell	

Learning Resources
Text Books
Ramarao Sri, Choudary Nityanand and Prasad Daruka, ”Lab Manual of Engineering Physics”., Vth ed., Excell Books, 2010
Reference Books
Semiconductor Devices & Physics, S.M.Sze, Wiley, 2008.
e- Resources & other digital material
https://www.niser.ac.in/sps/teaching-laboratories

PVP 19

BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

Course Code	19ES1151	**Year**	I	**Semester**	I
Course Category	Engineering Sciences	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	To familiarize the basic DC and AC networks used in electrical and electronic circuits.
CO2	To explain the concepts of electrical machines and their characteristics.
CO3	To identify the importance of transformers in transmission and distribution of electric power.
CO4	To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
CO5	To expose basic concepts and applications of Operational Amplifier and configurations

Contribution of Course Outcomes towards achievement of Program Outcomes &Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1					1		1	1	1	1
CO2	3	2	2	1			1		1		1	1		
CO3	3	2	2	1			1		1		1	1		
CO4	3	2	2	1			1		1		1	1	1	2
CO5	3	2	2	1			1		1		1	1	1	2
Average* (Rounded to nearest integer)	3	2	2	1			1		1		1	1	1	2

Syllabus

Expt. No.	Contents	Mapped CO
I	Verification of Kirchhoff‘s Laws KVL and KCL.	CO1
II	Verification of DC Superposition Theorem.	
III	Verification of Thevenin's Theorem and Norton's Theorem	
IV	Swinburne's tests on a DC shunt motor.	CO2

V	OC and SC Tests on single phase transformer.	CO3
VI	Brake Test on DC shunt motor.	CO2
VII	Current Voltage Characteristics of a p-n Junction Diode/LED	CO4
VIII	Diode Rectifier Circuits.	
IX	Voltage Regulation with Zener Diodes.	
X	Inverting and Non-inverting Amplifier Design with Op-amps	CO5

Learning Resources
Text Books
1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited, 2017. 2 B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1stedition, S.Chand Publishing, New Delhi, 2006. 3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.
Reference Books
1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011. 2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008. 3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.

PVP 19

COMMUNICATIVE ENGLISH – II

CourseCode	19HS1201	**Year**	I	**Semester**	II
Course Category	Humanities	**Branch**	ECE	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	Basic knowledge of grammar and fundamental concepts of Reading and Writing
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Demonstrate good writing skills for effective paraphrasing and synthesizing information
CO2	Analyze facts from opinions while reading and writing formal letters and e mails using a range of vocabulary in formal writing
CO3	Evaluate reading texts and learn good writing skills for effective argumentative essaysand formal correspondence.
CO4	Understand the structure of project reports applying grammatically correct structures and knowledge of grammar
CO5	Develop advanced reading skills for deeper understanding of texts and employability skills.

Contribution of Course Outcomes towards achievement of Program Outcomes& Strength ofcorrelations (H-High, M-Medium, L- Low)

	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3		3		
CO2										3		3		
CO3										3		3		
CO4										3		3		
CO5										3		3		
Average* (Rounded to nearest integer)										3		3		

SYLLABUS

UNIT NO.	CONTENT	Mapped CO
I	**Reading:** Reading for presenting - strategies to select, compile and synthesize information for presentation-Comprehending a wide range of texts -Reading to recognize academic style **Reading for Writing:** Paraphrasing - using quotations and in-text references; using academic style - avoiding colloquial words and phrases - Writing an essay after researching a topic - Citing the sources used **Grammar and Vocabulary:** Academic verbs in context; formal words and phrases-Awareness about Root words	CO1
II	**Reading:** Recognizing formal and informal styles -Recognizing the difference between facts and opinions - Identifying and understanding different perspectives	CO2

	Writing: Letter writing and e mail writing - Structure, Conventions and Etiquette – Informal, semi-formal and formal (enquiry, complaints, seeking permission, seeking internship - Re-draft a piece of text from a different perspective - Writing brief critical reviews of short texts **Grammar and Vocabulary:** Agreement: Subject-verb, Noun-pronoun; Editing short texts - Phrasal verbs - Phrasal prepositions - Avoiding clichés	
III	**Reading:** Identifying claims, evidences, views/opinions, purpose, and stance/position -Understand the correlation between a talk and a reading text based on inferences made. **Writing:** Writing structured analytical and argumentative essays on general topics using suitable claims and evidences with the sources cited-Peer review of the essays written **Grammar and Vocabulary:** Language for different functions such as stating a point, expressing opinion, Agreeing/disagreeing, Adding information to what someone has stated, and asking for clarification - Modifiers and misplaced modifiers	CO3
IV	**Reading:** Reading varied text types - Structure and contents of a formal report -Sections in a report and understanding the purpose of each section- Significance of references **Writing:** Writing reports **Grammar and Vocabulary:** Active and passive voice - Use of passive verbsin academic writing	CO4
V	**Reading:** Reading for inferential comprehension **Writing:** Writing one's CV and cover letter - Applying for a job/internship **Grammar and Vocabulary:** Reinforcing learning - Edit one's writing to correct common errors in grammar and usage - Use appropriate vocabularyfor speaking and writing – Various purposes	CO5

Learning Resources
Reference Books
Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012(Student Book, Teacher Resource Book, CD & DVD)
e- Resources & other digital material:
Grammar/Listening/Writing 1-language.com; http://www.5minuteenglish.com/ https://www.englishpractice.com/Grammar/Vocabulary: English Language Learning Online; http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/; http://www.nonstopenglish.com/ https://www.vocabulary.com/; BBC Vocabulary Games **Free Rice Vocabulary GameReading** https://www.usingenglish.com/comprehension/; https://www.englishclub.com/reading/short-stories.htm; https://www.english-online.at/ **All Skills** https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/Online Dictionaries: Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

PVP 19

ENGINEERING MATHEMATICS – II

(ODE, PDE AND MULTIVARIABLE CALCULUS)

Course Code	19BS1201	**Year**	I	**Semester**	II
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Calculus & Algebra
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Solve the differential equations related to various engineering fields.
CO2	Solve the linear differential equation with constant coefficients.
CO3	Identify solution methods for partial differential equations that model physical processes.
CO4	Interpret the physical meaning of gradient, curl and divergence.
CO5	Determine the work done against a force field, circulation and flux using vector calculus.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2											1	
CO2	3	2											1	
CO3	3	2											1	
CO4	3	2											1	
CO5	3	2											1	
Average * (Rounded to nearest integer)	3	2											1	

Syllabus

Unit No.	Contents	Mapped CO
I	**Linear Differential Equations of Higher Order:** Definitions,complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.	CO1
II	**Equations Reducible to Linear Differential Equations and Applications:** Cauchy‘s and Legendre‘s linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.	CO2
III	Partial Differential Equations: First order partial differential equations, solutions of first order linear PDEs, Charpit‘s method, solutions to homogenous and non-homogenous linear partial differential equations.	CO3

IV	**Multivariable Calculus (Vector Differentiation):** Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities	CO4
V	**Multivariable Calculus (Vector Integration):** Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).	CO5

Learning Resources
Text Books
1. Erwin Kreyszig, Advanced Engineering Mathematics,10/e, John Wiley & Sons, 2018 2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers,2017.
Reference Books
1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002. 2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e,Pearson Publishers, 2013. 3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
e- Resources & other digital material
www.nptelvideos.com/mathematics/ https://nptel.ac.in/courses/111104025/ https://nptel.ac.in/courses/122101003/

PVP 19

ENGINEERING CHEMISTRY

Course Code	19BS1203	**Year**	I	**Semester**	II
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	30	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	List various sources of renewable energy.
CO2	Compare different types of cells.
CO3	Explain the merits of fuel cells.
CO4	Identify suitable methods for metal finishing.
CO5	Distinguish between nano clusters and nano wires, polymers, molecular machines & switches

Contribution of Course Outcomes towards achievement of Program Outcomes &Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													1
CO2	3													1
CO3	3		2											1
CO4	3		2											1
CO5	3													1
Average* (Rounded to nearest integer)	3		2											1

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**ELECTROCHEMICAL ENERGY SYSTEMS** Introduction-Origin of electrode potential, Electrode Potentials, Measurement of Electrode Potentials, Nernst Equation for a single electrode, EMF of a cell, Types of Electrodes or Half Cells-Hydrogen and Calomel electrode, Electrochemical Cell, Galvanic Cell vs Electrolytic Cell, Electrochemical conventions, Types of Ion Selective Electrodes- glass membrane electrode, polymer membrane electrodes, solid state electrodes, gas sensing electrodes (Classification only), Concentration Cells.	CO1
II	**BATTERY TECHNOLOGY** Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries-zinc air, lithium cells-Li MnO2 cell-challenges of battery technology. Fuel cells- Introduction -	CO2

	classification of fuel cells – hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuel cell.	
III	**RENEWABLE SOURCES OF ENERGY** Introduction- sources of renewable energy Solar energy – Introduction - Physical and Chemical properties of Silicon- Production of Solar Grade Silicon from Quartz - Doping of Silicon- p and n type semi-conductors- PV cell / solar cell- Manufacturing of Photovoltaic Cells using Chemical Vapor Deposition Technique- applications of solar energy	CO3
IV	**METAL FINISHING** Technological importance of metal finishing, methods of metal finishing, manufacturing of electronic components, electrochemical techniques of forming, machining and etching, electrolytic cell, principle of electroplating, nature of electrodeposits, electroplating process, Electroplating of chromium, gold etc. Electroless plating of copper, nickel	CO4
V	**POLYMERS, NANOMATERIALS AND MOLECULAR MACHINES & SWITCHES:** Polymers: Introduction thermoplastic and thermo setting resins, Preparation, properties and uses of polystyrene and Polyphosphazines, differences between Nano materials: Introduction to nanomaterial: nanoparticles, nano cluster, carbon nanotube (CNT) and nanowires. Chemicalsynthesis of nano materials: sol-gel method. Characterization: Principle and applications of scanning electron microscope (SEM) and transmission electron microscope (TEM). Molecular machines & Molecular switches: Rotaxanes and Catenanes as artificial molecular machines; Molecular switches – cyclodextrin-based switches	CO5

Learning Resources
Text Books
1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014) 2. B.K. Sharma, Engineering Chemistry, Krishna Prakashan, Meerut. 3. O G Palanna, Engineering Chemistry, Tata McGraw Hill (2009).
Reference Books
1. Sashichawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003) 2. B.S Murthy and P. Shankar, A Text Book of Nano Science and Nano Technology,University Press (2013). 3. S.S. Dara, A Textbook of Engineering Chemistry, S.Chand& Co, (2010) 4. N.Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014). 5. K. Sesha Maheshwaramma and Mridula Chugh, Engineering Chemistry, Pearson India Edn services, (2016).
e- Resources & other digital material
https://nptel.ac.in/courses/105105178/ http://202.53.81.118/course/view.php?id=82

PVP 19

PROBLEM SOLVING AND PROGRAMMING

CourseCode	19ES1202	**Year**	I	**Semester**	II
Course Category	Engineering Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	4	**L-T-P**	3-1-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Develop algorithm and flowchart for simple problems.
CO2	Understand the structure, fundamentals and decision making statements in C.
CO3	Choose suitable iterative statements and arrays to solve the problems.
CO4	Solve problems using functions and pointers.
CO5	Apply the structures, unions and file operations in a specific need.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1:Low)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	2										1	2	2
CO2	1	1											2	2
CO3	2	2	2									1	2	2
CO4	2	2	2									1	2	2
CO5	2	2	2									1	2	2
Average * (Rounded to nearest integer)	2	2	2									1	2	2

Syllabus

Unit No.	Contents	Mapped CO
I	Introduction to Computer Problem-Solving – Introduction, The Problem-Solving Aspect, Top-Down Design, Fundamental Algorithms – Exchanging the values of two variables, Counting, Summation of a Set of Numbers, Factorial Computation, Sine Function Computation, Generation of the Fibonacci Series. Basics of Flow charts.	CO1
II	**Introduction to C:** Introduction, Structure of C Program, A Simple C Program, C-Tokens, Basic Data types, Variables, Constants, Input / Output statements, Operators, Type conversion and Type casting. **Conditional Branching Statements:** if, if-else, if-else-if Statements and Switch case.	CO2
III	**Iterative Statements:** while, for and do - while loops, Nested loops, break and continue statements. **Arrays:** Declaration, Accessing array elements, Storing values, Operations on arrays, Multi-dimensional arrays. **Strings:** Introduction, String manipulation functions.	CO3

IV	**Functions:** Introduction, Using Functions, Function declaration, Function definition and Function call, Parameter passing, Passing arrays to functions, Recursion, Storage classes. **Pointers:** Declaration and Initialization of pointer variables, Pointer arithmetic, Pointers and arrays, Pointer to pointer, Array of pointers, Pointers and functions, Dynamic memory allocation.	CO4
V	**Structures:** Introduction, Nested structures, Array of structures, Structures and functions, Unions. **Files in C:** Using Files in C, Read data from files, Writing data to files, Random access to files of records.	CO5

Learning Resources
Text Books
1. R.G. Dromey, How to Solve it by Computer, 1/e, Pearson Education, 2006. (ForUnit I). 2. Reema Thareja, Programming in C, Oxford University Press, AICTE Edition, 2018.
Reference Books
1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning, 2007. 2. Pradip Dey, Manas Ghosh, Programming in C, Oxford University Press, AICTE Edition, 3. B. Gottfried, Programming with C, 3/e, Schaum's outlines, McGraw Hill (India), 2017. 4.Jeri R. Hanly, Ellot B. Koffman, Problem Solving and Program Design in C, 5/e, Pearson.
e- Resources & other digital material
1. http://cprogramminglanguage.net/ 2. https://www.geeksforgeeks.org/c-programming-language/ 3. https://nptel.ac.in/courses/106105085/4

PVP 19

COMMUNICATIVE ENGLISH - II LAB

Course Code	19HS1251	**Year**	I	**Semester**	II
Course Category	Humanities	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Fundamental knowledge of Listening and Speaking skills
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the purpose of a presentation and learn strategies to present the text.
CO2	Comprehend talks/lectures and answer inferential questions using PPTs/audio- visual aids
CO3	Analyze the comprehensive ability and logical thinking for better listening and speaking.
CO4	Facilitate active listening to enable inferential learning through expert lectures and talks and team up with a colleague to participate well in role plays.
CO5	Develop advanced listening skills for an in-depth understanding of complex texts and collaborate with a partner for effective performance in mock interviews

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength ofcorrelations (H-High, M-Medium, L- Low)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1									2	3		3	1	
CO2									2	3		3	1	
CO3									2	3		3	1	
CO4									2	3		3	1	
CO5									2	3		3	1	
Average* (Rounded to nearest integer)									2	3		3	1	

SYLLABUS		
Expt. no	**CONTENT**	**Mapped CO**
1	Listening for presentation strategies and answering questions on the speaker, audience, and key points	CO1
2	Formal presentations using PPT slides (individual)	
3	Relating a reading text to a talk/presentation – understanding different perspectives and drawing inferences	CO2
4	Formal team presentations using PPT slides/audio- visual aids	
5	Identifying views and opinions expressed by different speakers while listening to discussions	CO3
6	Group discussion on general topics	
7	Processing of information using context clues while listening to talks/lectures	CO4

8	Role plays – people from various fields of work	
9	Processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge	CO5
10	Mock interviews for jobs/internships	

LEARNING RESOURCES
Reference Books:
1. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2ndEdition, 2018. 2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 3. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012(Student Book, Teacher ResourceBook, CD & DVD)
e- Resources & other digital material:
Grammar/Listening/Writing: 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ **Listening:** https://learningenglish.voanews.com/z/3613; http://www.englishmedialab.com/listening.html **Speaking:** https://www.talkenglish.com/BBC; Learning English – Pronunciation tipsMerriam-Webster – Perfect pronunciation Exercises **All Skills:** https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ **Online Dictionaries:** Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

PVP 19

ENGINEERING CHEMISTRY LAB

CourseCode	19BS1251	**Year**	I	**Semester**	II
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Explain the functioning of the instruments such as pH, Conductometric and Potentiometric methods.
CO2	Identify different ores (Cr & Cu) and their usage in different fields (industry, software devices, electronic goods).
CO3	Experiment with the physical parameter of organic compounds.
CO4	Compare the viscosities of oils.
CO5	List the preparation of polymers and nano materials.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2											1
CO2	3		2											1
CO3	3		2											1
CO4	3		2											1
CO5	3		2											1
Average* (Rounded to nearest integer)	3		2											1

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	Determination of strength of an acid by pH metric method	CO1
II	Determination of conductance by conductometric method	
III	Determination of viscosity of a liquid	CO4
IV	Determination of surface tension of a liquid	CO3
V	Determination of chromium (VI) in potassium dichromate	CO2
VI	Determination of Zinc by EDTA method	
VII	Estimation of active chlorine content in Bleaching powder	CO3
VII	Preparation of Phenol-Formaldehyde resin	CO5
IX	Preparation of Urea-Formaldehyde resin	
X	Thin layer chromatography	CO3

Learning Resources
Text Books
N.KBhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, DhanpatRai Publishing Company (2007).
Reference Books
Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).
e- Resources & other digital material
https://nptel.ac.in/courses/105105178/ http://202.53.81.118/course/view.php?id=82

PVP 19

PROBLEM SOLVING AND PROGRAMMING LAB

Course Code	19ES1252	**Year**	I	**Semester**	II
Course Category	Engineering Sciences	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Build algorithm and flowchart for simple problems.
CO2	Use suitable control structures to solve problems.
CO3	Use suitable iterative statements and arrays to solve the problems.
CO4	Implement Programs using functions and pointers.
CO5	Develop code for complex applications using structures, unions and file handling features.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2										1	2	2
CO2	2	2	2		2							1	2	2
CO3	2	2	2		2							1	2	2
CO4	2	2	2		2							1	2	2
CO5	2	2	2		1							1	2	2
Average* (Rounded to nearest integer)	2	2	2		2							1	2	2

Syllabus

Expt. No.	Contents	Mapped CO
I	Draw flowcharts for fundamental algorithms.	CO1
II	C Programs to demonstrate C-tokens.	CO2
III	C Programs on usage of operators.	
IV	C Programs to demonstrate Decision making and branching (Selection)	
V	C programs to demonstrate different loops.	CO3
VI	C programs to demonstrate 1-D arrays.	
VII	C programs to demonstrate multi-dimensional arrays.	
VIII	C programs to perform operations on strings with String handling functions and without String handling functions.	
IX	C programs to demonstrate functions.	CO4
X	C programs on pointers.	
XI	C programs on structures and unions.	
XII	C programs to demonstrate files.	

Learning Resources
Text Books
1. R.G. Dromey, How to Solve it by Computer, 1/e, Pearson Education, 2006. 2. Reema Thareja, Programming in C, Oxford University Press, AICTE Edition, 2018.
Reference Books
1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning, 2007. 2. Pradip Dey, Manas Ghosh, Programming in C, Oxford University Press, AICTE Edition, 3. B. Gottfried, Programming with C, 3/e, Schaum's outlines, McGraw Hill (India), 2017. 4.Jeri R. Hanly, Ellot B. Koffman, Problem Solving and Program Design in C, 5/e, Pearson.
e- Resources & other digital material
1. http://cprogramminglanguage.net/ 2. https://www.geeksforgeeks.org/c-programming-language/ 3. https://nptel.ac.in/courses/106105085/4

PVP 19

BASIC WORKSHOP

CourseCode	19ES1253	**Year**	I	**Semester**	II
Course Category	Engineering Sciences	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Apply wood working skills in real world applications
CO2	Build different parts with metal sheets in real world applications.
CO3	Apply fitting operations in various applications.
CO4	Apply different types of basic electric circuit connections and demonstrate soldering.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3					1			3		1			
CO2	3					1			3		1			
CO3	3					1			3		1			
CO4	3					1			3		1			
Average * (Rounded to nearest integer)	3					1			3		1			

Syllabus		
Job Type	**Contents**	**Mapped CO**
Wood Working	Familiarity with different types of woods and tools used in wood working and make following joints Half – Lap joint. Mortise and Tenon joint. Corner Dovetail joint or Bridle joint.	CO1
Sheet Metal Working	Familiarity with different types of tools used in sheet metalworking, Developments of following sheet metal job from GI sheets Tapered tray, Conical funnel ii) Elbow pipe	CO2
Fitting	Familiarity with different types of tools used in fitting and do the following fitting exercises V-fit Semi-circular fit iii) Bicycle tire puncture and change of two wheeler tire	CO3
Electrical Wiring	Familiarities with different types of basic electrical circuits and make the following connections Preparation of a circuit for Parallel and series connection. ii) Preparation of a circuit Go down lighting using two way switch and tube light. Soldering of wires	CO4

Learning Resources
Text Books
1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers. 2. Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition

PVP 19

ELECTRONICS WORKSHOP

Course Code	19EC3251	**Year**	I	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	BEEE
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Decode the Resistance values & tolerances.
CO2	Understand and use RPS, voltmeter, ammeter, multimeter, function generator and CRO.
CO3	Study and use breadboard for various circuit wiring.
CO4	Fabricate simple circuits on a PCB and test them.
CO5	Understand various hardware parts of a computer.
CO6	Complete a hobby project and test it.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3		2	3			2				2	2
CO2	3		3		2	3			2				2	2
CO3	3		3		2	3			2				2	2
CO4	3		3		2	3			2				2	2
CO5	3		3		2	3			2				2	2
CO6	3		3		2	3			2		3	2	2	2
Average* (Rounded to nearest integer)	3		3		2	3			2		3	2	2	2

Syllabus

Expt. No.	**Contents**	**Mapped CO**
I	Study of resistance color codes, identification of active and passive Electronic components.	CO1
II	Study and use of Bread Board Trainer Kit.	CO3
III	Study of multimeter and CRO.	CO2
IV	Study of function Generator and Regulated Power supply.	CO2
V	Soldering of Electronic components on PCBs.	CO4
VI	Function of diode as a switch.	CO2
VII	Different types of batteries.	CO2
VIII	Voltage measurement using solar panel.	CO2
IX	Battery charger using microcontroller.	CO5

X	Study of Computer system hardware.	CO5
XI	Mini Hobby Project	CO6

Learning Resources
Text Books
1. Electronics Lab Manual –Volume-1-PHI- KA NAVAS Fifth Edition 2. laboratory Manual for Introductory Electronics Experiments- New Age International (P) Ltd
e- Resources & other digital material
1. http://www.circuitstoday.com/simple-electronics-projects-and-circuits 2. https://study.com/academy/lesson/what-is-computer-hardware-components-definition

PVP 19

II YEAR

PVP 19

ENGINEERING MATHEMATICS-III
(COMPLEX VARIABLES &TRANSFORM TECHNIQUES)

Course Code	19BS1301	**Year**	II	**Semester**	I
Course Category	Basic Sciences course	**Branch**	CE/EEE/ ME/ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	Determine Laplace transform and inverse Laplace transforms of given function(s).
CO2	Develop a Fourier series in terms of sine and cosine of a given function.
CO3	Find out Fourier sine and cosine transforms.
CO4	Determine complex potential function, evaluate integrals by applying Cauchy's integral formula and construct series expansions of complex functions.
CO5	Apply method of separation of variables to find the solution of wave, heat, Laplace equations with given boundary conditions.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					2						2	
CO2	3	2											2	
CO3	3	2											2	
CO4	3	2											2	
CO5	3	2					2						2	
Average* (Rounded to nearest integer)	3	2					2						2	

Syllabus

UNIT No.	Contents	Mapped COs
I	**Laplace Transforms & Inverse Laplace Transforms** Definition of Laplace transform, properties of Laplace transforms, transforms of derivatives, transforms of integrals, multiplication by t^n, division by t, unit step function, unit impulse function. Inverse Laplace transforms by partial fractions, convolution theorem (All theorems/properties without proofs)	CO1
II	**Fourier Series** Fourier series, Dirichlet's conditions, functions of any period, odd and even functions - half range series. (All theorems/properties without proofs)	CO2
III	**Fourier Transforms 6hrs** Fourier integrals, Fourier cosine and sine integrals, Fourier transform, sine and cosine transform. (All theorems/properties without proofs)	CO3

IV	**Complex Variables** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Cauchy theorem, Cauchy integral formula, Taylor's series, Laurent's series. (All theorems/properties without proofs)	CO4
V	**Applications of Partial Differential Equations** Classification of second order partial differential equations, method of separation of variables, solutions of one dimensional wave equation, one dimensional heat equation and two dimensional Laplace's equation in Cartesian coordinates.(All theorems/properties without proofs)	CO5

Learning Recourses
Text Book(s)
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44/e, 2019. 2. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
Reference Book(s)
1. N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications, 2008.
e- Resources & other digital material
1. https://www.nptel.ac.in/courses/111/105/111105123/ 2. https://www.nptel.ac.in/courses/111/105/111105134/ 3. https://www.nptel.ac.in/courses/111/105/111105093/

PVP 19

AI TOOLS

Course Code	19ES1401	**Year**	II	**Semester**	II
Course Category	Engineering Sciences	**Branch**	Common to All Branches	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	-
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the Fundamentals of Artificial Intelligence and its Applications.
CO2	Summarize various machine learning methods.
CO3	Identify different machine learning applications.
CO4	Compare Machine Learning & Deep Learning and Outline basic Deep Learning Algorithm.
CO5	Make use of Deep Learning Concepts for various Applications.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												1	2
CO2	2	2											2	2
CO3	2	2		2									2	3
CO4	2	2											2	2
CO5	2	2	2	2		1						2	2	3
Average* (Rounded to nearest integer)	2	2	2	2		1						2	2	3

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to Artificial Intelligence:** What is AI, Foundations of AI, Goals of AI, and Applications of AI.	**CO1**
II	**Machine Learning: Definition, Learning Methods:** Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning.	**CO2**
III	**Machine Learning Applications:** Computer vision, Speech Recognition, Natural Language Processing, Decision Making process.	**CO3**
IV	**Deep Learning**: Basics of Deep Learning, Machine Learning Vs Deep Learning, Fundamental Deep Learning Algorithm- Convolution Neural Network (CNN).	**CO4**
V	**Deep Learning Applications:** Computer vision, Speech Recognition, Natural Language Processing, Decision Making process.	**CO5**

Learning Resources
Text Books
1. Artificial Intelligence: A Modern Approach, Stuart Russell and Norvig, Third Edition, 2015, Pearson Education. **(Unit-1)** 2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2012, MIT Press **(Unit-2&3)** 3. Deep Learning (Adaptive Computation and Machine Learning series), Ian Good fellow, Yoshua Bengio, Aaron Courville, Francis Bach, 2017, MIT Press. **(Unit- 4 & 5)**
e-Resources& other digital material
1. https://swayam.gov.in/nd1_noc19_cs52/preview 2. https://swayam.gov.in/nd1_noc19_cs85/preview 3. https://emerj.com/ai-sector-overviews/machine-learning-healthcare-applications/

PVP 19

DESIGN THINKING & PRODUCT INNOVATION

Course code	19ES1302	**Year**	II	**semester**	I
Course category	Engineering Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**prerequisites**	Nil
Continuous Internal evaluation	30	**Semester End Evaluation**	70	**Total marks**	100

Course outcomes	
Upon successful completion of the course the student will able to	
CO1	Explain the principles of design thinking and its approaches
CO2	Identify the empathy, define phases in human centred design problems
CO3	Understand the idea generation, prototype and testing in design thinking context
CO4	Apply design thinking techniques for product innovation
CO5	Use design thinking in business process models

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3			1						1		2
CO2			3	2		1			2	2		1		2
CO3			3	2		1			3	2		1		2
CO4			3	2		1			2	2		1	2	2
CO5			3	2		1			2	2	1	1		2
Average* (Rounded to nearest integer)			3	2		1			3	2	1	1	2	2

Syllabus

Unit no	**Contents**	**Mapped CO**
I	**Introduction To Design Thinking:** An insight into Design, origin of Design thinking, Design thinking Vs Engineering thinking, importance of Design thinking, Design Vs Design thinking, understanding Design thinking and its process models, application of Design thinking	CO1
II	**Empathize In Design Thinking:** Human-Centred Design (HCD) process - Empathize, Define, Ideate, Prototype and Test and Iterate. Role of Empathy in design thinking, methods and tools of empathy, understanding empathy tools. Explore define phase state users' needs and problems using empathy methods	CO2
III	**Ideation, Prototyping and Testing :** Ideation methods, brain storming, advantages of brain storming, methods and tools of ideations, prototyping and methods of prototyping, user testing methods, Advantages and disadvantages of user Testing/ Validation	CO3
IV	**Product Innovation:** Design thinking for strategic innovation , Definition of innovation, art of innovation, teams for innovation, materials and innovation in	CO4

	materials, definition of product and its classification. Innovation towards product design Case studies	
V	**Design Thinking in Business Processes:** Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs.	CO5

Learning Resources
Text Books:
1. "Change by design", Tim Brown, Harper Collins, 2009 2. Engineering design by George E Dieter
References:
1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization by Vijay Kumar 2. Human - Centered Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World by IDEO 3. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013). 4. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan
Additional Learning Resources
1. https://www.interaction-desiqn.ora/literature/topics/desiqn-th/nkinq 2. https://www.interaction-desiqn.prq/literature/article/how-tq-<eve'op-an-empath\capproach-in-design-thinking

PVP 19

NETWORK THEORY AND ANALYSIS

Course Code	19EC3301	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyse various networks by applying transformation techniques, mesh analysis, nodal analysis and network theorems
CO2	Analyse various circuits in the time and transform domains using transient analysis methods
CO3	Determine steady state response of RC, RL and RLC circuits for sinusoidal excitation
CO4	Evaluate the bandwidth and quality factor of series and parallel resonant circuits
CO5	Determine the characteristics of different two port networks

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L: Low)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	2			1	1	1		1	2	1
CO2	3	3	2	2	2			1	1	1		1	2	1
CO3	3	3	2	2	2			1	1	1		1	2	1
CO4	3	3	2	2	2			1	1	1		1	2	1
CO5	3	3	2	2	2			1	1	1		1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2			1	1	1		1	2	1

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**Introduction:** Ohms law, Kirchhoff's laws, series and parallel circuits, source transformations, delta-wye conversion, linearity and superposition theorem with simple examples, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem, mesh, super mesh analysis, nodal, super node analysis.	CO1
II	**Analysis of circuits**: transient analysis of first order and second order systems, initial and final conditions in networks, dc transients: source free and forced response of RL, RC and RLC circuit analysis using Laplace transform.	CO2
III	**Sinusoidal Steady-State Analysis:** sinusoids, sinusoidal functions and complex functions, instantaneous power, average power, effective values of current and voltage, apparent power and power factor, complex power, phasors, phasor relationships for R, L and C and steady state analysis of RL, RC and RLC circuits.	**CO3**
IV	**Resonance:** series resonance, parallel resonance, bandwidth, selectivity, quality factor.	**CO4**
V	**Two Port Networks:** impedance parameters, admittance parameters,	**CO5**

	hybrid parameters and transmission parameters, relationships between parameters.	

Learning Resources
Text Books
1. M.E.Van Valkenburg, Network Analysis, III Edition , Pearson Education / PHI 2. A. Sudhakar and Shyammohan S.Palli, Network Analysis, Tata McGraw Hill Publication
Reference Books
1. William H Hayt, Jack E Kimmerly and Steven M.Durbin, Engineering Circuit Analysis, Tata McGraw Hill 2. A. Chakrabarti, Circuit Theory: Analysis and Synthesis, Dhanpat Rai Publishing Co Pvt Ltd 3. John O. Attia, Electronics and Circuit Analysis using MATLAB, CRC Press
e- Resources & other digital material
1. https://www.youtube.com/playlist?list=PLC7D3EAEFA0CC0420&app=desktop 2. https://www.tutorialspoint.com/network_theory/network_theory_quick_guide.htm 3. https://nptel.ac.in/courses/108/105/108105159/

PVP 19

ELECTRONIC DEVICES AND AMPLIFIER CIRCUITS

Course Code	19EC3302	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	BEEE
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Characterize and analyse BJT amplifiers at low and high frequencies
CO2	Determine MOSFET amplifier performance at low and high frequencies.
CO3	Adapt different models of BJT and MOSFET circuits for improving the IC performance
CO4	Design single stage and multistage differential amplifiers using MOSFET.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	2			1	1	1		2	2	1
CO2	3	3	2	2	2			1	1	1		2	2	1
CO3	3	3	2	2	2			1	1	1		2	2	1
CO4	3	3	2	2	2			1	1	1		2	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2			1	1	1		2	2	1

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**Bipolar Junction Transistors:** Device structure and physical operation, current-voltage characteristics, the BJT as an amplifier and as a switch, BJT circuits at dc, biasing in BJT amplifier circuits, small signal operation and models.	CO1
II	**MOS Field-Effect Transistors:** Device structure and physical operation, current-voltage characteristics, MOSFET circuits at dc, the MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation and models.	CO2
III	IC Design Philosophy, Comparison of the MOSFET and the BJT, IC biasing-current sources, current mirrors and current-steering circuits, current-mirror circuits with improved performance.	**CO3**
IV	**Single Stage MOSFET Amplifiers:** Estimating 3dB frequency of amplifiers, Basic MOSFET amplifier configurations, MOSFET internal capacitances and high frequency model. Low Frequency and High Frequency Response of Common Source, Common Gate and Common Drain Amplifiers.	**CO2**
V	**Differential Amplifiers:** The MOS differential pair, small-signal operation of the MOS differential pair, other non-ideal characteristics	**CO4**

	of MOS differential amplifier, the MOS differential amplifier with active load, multistage MOS amplifiers.	

Learning Resources
Text Books
1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press, 2013.
Reference Books
1. Behzad Razavi, Fundamentals of Microelectronics, 2/e, Wiley Student Edition, 2013. 2. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, 10/e, Pearson Education, 2009. 3. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
e- Resources & other digital material
1. http:// www.faadooengineers.com/threads/4615-Electronic-Devices-and-Circuit-Theory-Boylestad-and-Nashelsky 2. https://docplayer.net/53934331-J-b-gupta-electronic-devices-and-circuits.html

PVP 19

SIGNALS AND SYSTEMS

Course Code	19EC3303	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Recognize** different characteristics of signals and systems
CO2	**Determine** the response of LTI system to any arbitrary input signal using convolution
CO3	**Resolve** continuous-time signals in frequency domain using Fourier series and Fourier transform
CO4	**Analyse** discrete-time signals and systems using DTFT
CO5	**Apply** the concepts of Laplace transform/Z-transform to analyze continuous-time/discrete-time signals in complex plane

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Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	3	2	2	2							2	2	1
CO2	3	3	3	2	2							2	2	1
CO3	3	3	2	2	2							2	2	1
CO4	3	3	3	2	2							2	2	1
CO5	3	3	2	2	2							2	2	1
Average* (Rounded to nearest integer)	3	3	3	2	2							2	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Signals and Systems:** Continuous-time and Discrete-time signals, Transformations of the independent variable, Exponential and Sinusoidal signals, The unit impulse and unit step functions, Continuous-time and Discrete-time systems, Basic System properties.	CO1
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.	CO2
III	**Fourier analysis of Continuous Time Signals and Systems:** Fourier series representation of continuous time periodic signals, convergence of the Fourier series, Properties of continuous-time Fourier series. The Continuous-Time Fourier Transform: The Fourier transform for periodic	CO3

	signals. Properties of the Continuous-time Fourier transform, Systems characterized by linear constant-coefficient differential equations.	
IV	**Fourier analysis of Discrete Time Signals and Systems:** The Discrete-Time Fourier Transform, Properties of the Discrete-time Fourier transform, The Fourier transform for periodic signals. Systems characterized by linear constant-coefficient difference equations.	CO4
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.	CO5

Learning Resources
Text Books
1. Alan V. Oppenheim, Alan S. Wilsky with S.Hamid Nawab, 'Signals and Systems', 2/e, Pearson Education, 1997.
Reference Books
1. Bhagawan das P. Lathi, 'Linear Signals and Systems', Oxford University Press, 2009. 2. Simon Haykin, Barry Van Veen, 'Signals and Systems', 2/e, Wiley Student Edition. 3. Luis Chaparro, Signals and Systems using MATLAB, Kindle Edition,
e- Resources & other digital material
1. http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Signals%20and %20System/TOC-M1.htm 2. http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Signals%20and %20System/Course%20Objective.htm 3. http://www.stanford.edu/~boyd.ee102 4. http://www.ece.gatech.edu/users/bonnie/book 5. http://ocw.mit.edu

PVP 19

CONSTITUTION OF INDIA

Course Code	19MC1302	**Year**	II	**Semester**	I
Course Category	Mandatory course	**Branch**	ECE	**Course Type**	Theory
Credits	0	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	100	**Semester End Evaluation**	0	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the meaning and importance of Constitution, Fundamental rights and duties, union government, state and local governments, other statutory bodies (L2).
CO2	Create awareness about social responsibilities (L5)
CO3	To apply the functioning of Union, State and Local Governments in Indian federal system (L3)
CO4	To analyze election commission and amendment procedure for various statuary bodies (L4).

Contribution of Course Outcomes towards achievement of Program Outcomes &Strength of correlations (3-High, 2: Medium, 1:Low)

COs	**PO1**	**PO 2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1					3	3	3				2		1
CO2						3	3	3				2		1
CO3						3	3	3				2		1
CO4						3	3	3				2		1
19MC1302	1					3	3	3				2		1

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Indian Constitution:** Constitutional history, constituent assembly, salient features of the constitution, significance of preamble, amending process of the constitution.	**CO1**
II	**Rights and Duties:** Citizenship, fundamental rights and directive principles, fundamental duties.	**CO1, CO2**
III	**Union Government:** President and vice president, election, removal and powers, prime minister and council of ministers, parliament, supreme court, union, state relations, emergency provisions.	**CO1, CO3**
IV	**State and Local Governments:** Governor, state legislature, assembly and council, chief minister and council of ministers, high court, rural and urban local governments with special reference to 73rd and 74th constitutional amendment acts.	**CO1, CO3**

V	**Other Constitutional and Statutory Bodies:** Comptroller and auditor general, election commission, finance commission, attorney general and advocate general, union public service commission (UPSC), state public service commissions (SPSCs), tribunals, national human rights commission (NHRC).	**CO1, CO4**

Learning Resources
Text Book(s):
1. J. C. Johari, Indian Government and Politics, Vishal Publications, Delhi, 2009. 2. M. V. Pylee, Introduction to the Constitution of India, 5/e, Vikas Publishing House, Mumbai, 2007
References:
1. D.D. Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis, Gurgaon, India, 2011. 2. Subhas C. Kashyap, Our Constitution, 2/e, National Book Trust India, New Delhi, 2013.

PVP 19

AI TOOLS LAB

Course Code	19ES1351	**Year**	II	**Semester**	I
Course Category	ES	**Branch**	**Common to All Branches**	**Course Type**	Lab
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	-
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Apply various preprocessing techniques on different datasets
CO2	Construct Machine learning programs for Supervised, Unsupervised and Semi supervised learning models.
CO3	Develop Deep learning programs for Supervised & Unsupervised learning models
CO4	Identify and Apply Artificial Intelligence concepts to solve real world problems

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2					1		2	1	2
CO2	3	3	2	1	2					1		2	1	2
CO3	3	3	2	1	2					1		2	1	2
CO4	2	2	3	1	2		1			1		2	1	3
Average* (Rounded to nearest integer)	3	3	3	1	2		1			1		2	1	3

Syllabus		
Exp. No.	**Contents**	**Mapped CO**
1	Apply Data pre-processing techniques	**CO1**
2	Construct a Machine Learning model using supervised learning method	**CO2**
3	Construct a Machine Learning model using Unsupervised learning method	**CO2**
4	Construct a Machine Learning model using Semi supervised learning method	**CO2**
5	Develop a Deep Learning model using supervised learning method	**CO3**
6	Develop a Deep Learning model using Unsupervised learning method	**CO3**
7	Apply a Convolutional Neural Network for Image Classification	**CO3**
8	Build an AI application	**CO4**

Learning Resources
Text Books
1. Artificial Intelligence: A Modern Approach, Stuart Russell and Norvig, Third Edition, 2015, Pearson Education 2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2012,MIT Press 3. Deep Learning (Adaptive Computation and Machine Learning series) , Ian Good fellow, Yoshua Bengio, Aaron Courville, Francis Bach, 2017, MIT Press
e-Resources & other digital material
1. https://github.com/atinesh-s/Coursera-Machine-Learning-Stanford 2. https://github.com/Kulbear/deep-learning-coursera

PVP 19

DESIGN THINKING & PRODUCT INNOVATION LAB

Course code	19ES1352	**Year**	II	**semester**	I
Course category	Engineering science	**Branch**	**Common to all Branches**	**Course Type**	Lab
Credits	1	**L-T-P**	0-0-2	**prerequisites**	nil
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total marks**	75

Course outcomes	
Upon successful completion of the course the student will able to	
CO1	Develop a mind maps for design thinking process
CO2	Prepare empathy maps and journey maps for problems.
CO3	Construct mock-up models through ideation and innovation techniques
CO4	Use software for design thinking problems

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2	2					3					2
CO2			2	2					3					2
CO3			2	2					3					2
CO4			2	2					3					2
Average* (Rounded to nearest integer)			2	2					3					2

NOTE: Any 12 of the following

Syllabus		
Exp NO	**List of Experiments**	**Mapped CO**
1	Design a mind map of design thinking	CO1
2	Thirty circle Exercise ---ideation	CO3
3	Prepared a toothpick bridge (mock-up model)	CO1,CO3
4	Prepared a marble maze (mock up model)	CO1,CO3
5	Build a wind power car (mock up model)	CO1,CO3
6	Make a hydraulic elevator (mock up models)	CO1,CO3
7	Construct empathy maps for a given case study-1	CO2
8	Develop customer journey map for a given case	CO2
9	Construct empathy maps for a given case study-2	CO2
10	Develop customer journey map for a given case -2	CO2
11	Make a paper prototype for user testing (mock-up model)	CO2
12	Design and development of cell phone wallet (mock-up model)	CO1,CO2,CO3
13	Design thinking using sprint base software	CO4
14	Design thinking using sprint base software	CO4

Learning Resources
Text Books
1. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013). 2. "Change by design", Tim Brown, Harper Collins, 2009 3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan 4. Engineering design by George E Dieter

Reference Books
1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization by Vijay Kumar 2. Human-Centered Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World by IDEO
Additional Learning Resources
1. https://www.interaction-desiqn.ora/literature/topics/desiqn-th/nkinq 2. https://www.interaction-desiqn.prq/literature/article/how-tq-<eve'op-an-empath\capproach-in-design-thinking

PVP 19

NETWORK THEORY AND ANALYSIS LAB

Course Code	19EC3351	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Nil
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyse various networks by applying transformation techniques, mesh analysis, nodal analysis and network theorems
CO2	Determine peak voltage, frequency, phase and time period of a signal using CRO
CO3	Analyse various circuits in the time and transform domains using transient analysis methods
CO4	Evaluate the bandwidth and quality factor of series and parallel resonant circuits
CO5	Determine the characteristics of different two port networks

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2			1	1	1		1	2	1
CO2	3	3	2	2	2			1	1	1		1	2	1
CO3	3	3	2	2	2			1	1	1		1	2	1
CO4	3	3	2	2	2			1	1	1		1	2	1
CO5	3	3	2	2	2			1	1	1		1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2			1	1	1		1	2	1

Syllabus

Expt. No.	Contents	Mapped CO
I	Experimental verification of Kirchhoff's voltage and current laws.	**CO1**
II	Experimental verification of Thevenin's and Norton's theorems.	**CO1**
III	Experimental verification of Superposition Theorem.	**CO1**
IV	Experimental verification of Maximum power transfer Theorem.	**CO1**
V	Measurement of sinusoidal voltage, frequency and power factor using CRO.	**CO2**
VI	Experimental determination of step response of RL, RC & RLC circuits.	**CO3**
VII	Experimental determination of time constant of series R-C electric circuits.	**CO3**
VIII	Experimental determination of frequency response of RLC circuits.	**CO3**
IX	For the given network function, draw the pole zero diagram and hence obtain the time domain response. Verify the result analytically. {Ex: V(s) = 5(s+5) / (S +2) (S + 7)}	**CO3**
X	Simulation of a given series resonance circuit.	**CO4**

XI	Simulation of a given parallel resonant circuits.	**CO4**
XII	Determination of two port network parameters for a given network.	**CO5**

Learning Resources
Text Books
1. M. E. Van Valkenburg, Network Analysis, III Edition , Pearson Education / PHI 2. A. Sudhakar and Shyammohan S.Palli, Network Analysis, Tata McGraw Hill Publication
Reference Books
1. William H Hayt, Jack E Kimmerly and Steven M.Durbin, Engineering Circuit Analysis, Tata McGraw Hill 2. A. Chakrabarti, Circuit Theory: Analysis and Synthesis, Dhanpat Rai Publishing Co Pvt Ltd 3. John O. Attia, Electronics and Circuit Analysis using MATLAB, CRC Press
e- Resources & other digital material
1. http://vlabs.iitkgp.ernet.in/asnm/ 2. https://www.youtube.com/playlist?list=PLC7D3EAEFA0CC0420&app=desktop 3. https://personal.utdallas.edu/~rmh072000/EE3101/readfirst.pdf

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PVP 19

ELECTRONIC DEVICES AND AMPLIFIERCIRCUITS LABORATORY

Course Code	**19EC3352**	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Measure the device small signal parameters of BJT and MOSFET
CO2	Design, simulate and implement BJT and MOSFET amplifiers for the given specifications.
CO3	Construct NMOS differential amplifier circuits for the given specifications.
CO4	Fabricate PCB for multivibrator circuits using BJT.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3			1	1	1	2	2	2	2
CO2	3	3	2	3	3			1	1	1	2	2	2	2
CO3	3	3	2	3	3			1	1	1	2	2	2	2
CO4	3	3	2	3	3			1	1	1	2	2	2	2
Average* (Rounded to nearest integer)	3	3	2	3	3			1	1	1	2	2	2	2

Syllabus

Expt. No.	**Contents**	**Mapped CO**
I	Voltage-Current Characteristics of BJT / Measurement of scale current & common emitter current gain	**CO1**
II	Measurement of small signal parameters (g_m, r_o, r_π, r_e) of BJT at a given operating (Q) point	**CO1**
III	Design, Simulate and Implement BJT amplifier and Inverter logic gate	**CO1**
IV	Voltage-Current Characteristics of MOSFET / Measurement of threshold voltage	**CO1**
V	Measurement of small signal parameters (g_m,r_o,g_{mb}) of MOSFET at a given operating point.	**CO1**
VI	Design and simulation of basic NMOS current mirror, cascode NMOS current mirror and current steering circuit	**CO2**
VII	Design and Simulation of Common Source Amplifier for Gain, Power dissipation requirements	**CO2**
VIII	Design and Simulation of Common Drain Amplifier (Voltage Buffer) for Gain, Output Impedance, Level Shift requirements	**CO2**

IX	Analysis and Verification of Basic NMOS Differential Pair for Gain, Input Common Mode Range, Maximum Input differential voltage requirements	**CO3**
X	Design and Simulation of Differential Amplifier with active current mirror load for gain, power dissipation CMRR requirements.	**CO3**
XI	Design, Simulation and PCB fabrication of a BJT Multivibrator Circuit	**CO4**

Learning Resources
Text Books
1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press, 2013
Reference Books
1. Behzad Razavi, Fundamentals of Microelectronics, 2/e, Wiley Student Edition, 2013. 2. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, 10/e, Pearson Education, 2009. 3. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
e- Resources & other digital material
1. https://www.researchgate.net/publication/314154179_Electronics_Lab_Manual 2. http://abexp.aiaiai.dk/electronic_devices_and_circuits_lab_manual_bgpltd.pdf

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PVP 19

ENGINEERING MATHEMATICS- IV

(PROBABILITY THEORY AND RANDOM PROCESSES)

Course Code	19BS1402	**Year**	II	**Semester**	II
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Engineering Mathematics-I (19EMA101) Engineering Mathematics-II (19EMA102)
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Apply the knowledge of probability to solve engineering problems
CO2	Distinguish various types of noise by using the probability distribution and density functions
CO3	Evaluate the characteristics of single and multiple random variables
CO4	Analyze the temporal characteristics of random processes
CO5	Evaluate the spectral characteristics of noise in communications

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1							2	2	
CO2	3	2	1	2	1							2	2	
CO3	3	3	1	2	1							2	2	
CO4	3	3	1	2	1							2	2	
CO5	3	3	1	2	1							2	2	
Average* (Rounded to nearest integer)	3	3	1	2	1							2	2	

Syllabus

Unit No.	Contents	Mapped COs
I	**Probability:** Probability introduced through sets and relative frequency, joint and conditional probability, independent events, combined experiments, Bernoulli trials.	CO1
II	**Random Variable:** Introduction, random variable concept, distribution function, density function, the Gaussian random variable, other distribution and density examples, conditional distribution and density functions. Operation on One Random Variable: Introduction, expectation, moments, functions that give moments, transformations of a random variable.	CO2& CO3

III	**Multiple Random Variables** Vector random variables, joint distribution and density functions, properties, conditional distribution and density, statistical independence, distribution and density of a sum of random variables, central limit theorem. Expected Value of a Function of Random Variables: Joint moments about the origin, joint central moments, jointly Gaussian random variables - two random variables case, N random variable case.	CO3
IV	**Random Process-I:** Temporal characteristics - the random process concept, stationary and statistical independence, correlation functions, Gaussian random processes, Poisson random process.	CO4
V	**Random Process-II:** Spectral characteristics, the power spectrum: Properties, relationship between power spectrum and autocorrelation function, the cross-power density spectrum: Properties, relationship between crosspower spectrum and cross-correlation function	CO5

Learning Resources
Text Books
1. Peyton Z. Peebles, Probability, Random Variables and Random Signal Principles, 4/e, Tata McGraw Hill, 2002. 2. Athanasios Papoulis, S. Unnikrishna Pillai, Probability, Random Variables and Stochastic Processes, 4/e, Tata McGraw Hill, 2002.
Reference Books
1. Simon Haykin, Communication Systems, 4/e, Wiley Student Edition, 2006. 2. Henry Stark, John W. Woods, Probability and Random Processes with Application to Signal Processing, 3/e, Pearson Education, 2002.
e- Resources & other digital material
1. http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Signals%20and %20System/TOC-M1.htm 2. http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Signals%20and %20System/Course%20Objective.htm 3. http://www.stanford.edu/~boyd.ee102 4. http://www.ece.gatech.edu/users/bonnie/book 5. http://ocw.mit.edu

PVP 19

LIFE SCIENCES FOR ENGINEERS

Course Code	19BS1404	**Year**	II	**Semester**	II
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	Apply the principles of biology to create tangible and economically viable engineering goods.
CO2	Know and illustrate bio-engineering field.
CO3	Analyse the importance of bioenergetics and apply the knowledge to improve the living standards of societies.
CO4	Gain the knowledge in genetic engineering.
CO5	Design and develop new technologies in genetic industrial field.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2							
CO2	3						2							
CO3	3						2							
CO4	3						2							
CO5	3						2							
Average* (Rounded to nearest integer)	3						2							

Syllabus

Unit No.	Contents	Mapped COs
I	**Introduction to Biology:** Comparison of Biological organisms with manmade systems- eye and camera, flying bird and aircraft. Classification of living organisms- Cellular basis of life, differences between prokaryotes and eukaryotes , classification on the basis of carbon and energy sources	CO1 CO3 CO5
II	**Bio-molecules:** Structure and functions of proteins and nucleic acids, hemoglobin, antibodies. Enzymes-Industrial applications, Fermentation and its industrial applications.	CO1 CO2
III	**Bioenergetics and Respiration:** Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis. Human physiology.	CO2 CO3
IV	**Genetic Engineering:** Mendel's laws, gene mapping, Mitosis and Meiosis, Epitasis, single gene disorders in humans. Genetic code	CO2, CO4 CO5
V	**Recombinant DNA Technology:** Recombinant vaccines, transgenic microbes, plants and animals. Animal cloning, biosensors, biochips.	CO1, CO4 CO5

Learning Recourses
Text Books
1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Ed.ltd, 2018. 2. Arthur T Johnson, Biology for Engineers, CRC press, 2011.
Reference Books
1. Alberts et al., The molecular biology of the cell, 6/e, Garland Science, 2014 2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009 3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012

PVP 19

DIGITAL LOGIC DESIGN

Course Code	19EC3401	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Compare the various features of Binary codes.
CO2	Simplify Boolean functions using K-map & implement them using Logic gates
CO3	Design and Realize various Combinational circuits for the given specifications
CO4	Analyze and Design Clocked Sequential circuits
CO5	Construct Logic gates using CMOS

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1: Low)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	2							1	2	1
CO2	3	3	2	2	2							1	2	1
CO3	3	3	2	2	2							1	2	1
CO4	3	3	2	2	3							1	2	1
CO5	3	3	2	2	3							1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	3							1	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Binary Codes**: Signed Binary Numbers, Complements, Binary Codes, Error detection and correction code, Binary Logic. **Boolean Algebra**: Basic definitions, Axiomatic definition of Boolean algebra, Basic theorems and properties of Boolean algebra, Boolean functions, Canonical and standard forms, Digital logic gates.	CO1
II	**Simplification of Boolean functions**: The map method, Four-variable map, Five-variable map, Tabulation Method, Product of sums simplification, Don't-care conditions, NAND and NOR implementation, Exclusive-or function. .	CO2
III	**Combinational Logic**: Combinational circuits, Analysis procedure, Design procedure, Binary Adder- Subtractor, Decoders, Encoders, Multiplexers, De-Multiplexer **Memories**: Random-access memory, Memory decoding, Read-only memory**.**	CO3
IV	**Synchronous Sequential Logic**: Sequential circuits, Latches, Flip-Flops, Analysis of clocked sequential circuits, State reduction and assignment, Design procedure	CO4

V	**Registers and Counters**: Registers, Shift registers, Ripple counters, Synchronous Counters, Ring counter. **Digital Integrated circuits**: Special characteristics, Complementary MOS (CMOS), CMOS transmission gate circuits.	CO5

Learning Resources
Text Books
1. Michael D. Ciletti, M. Morris Mano, Digital Design, 4/e. Pearson Education, 2007.
Reference Books
1. ZviKohavi, Switching and Finite Automata Theory, 2/e, Tata McGraw-Hill Education, 2008. 2. John F. Wakerly, Digital Design Principles and Practices, 4/e, Pearson Education, 2008. 3. Frederick J. Hill and Gerald R. Peterson, Introduction to Switching Theory and Logic Design, 3/e, John Willey and Sons, 1981. 4. Charles Roth, Jr., Larry Kinney, Fundamentals of Logic Design, 7/e, Cengage Learning, India, 2013.
e- Resources & other digital material
1. http://www.ece.ubc.ca/~saifz/eece256.html 2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Guwahati/digital_circuit /frame/index.html

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PVP 19

ELECTROMAGNETIC WAVES

Course Code	19EC3402	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Engineering Physics (19EPH131); Engineering Mathematics-I (19EMA101) Engineering Mathematics-II (19EMA102)
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Apply the knowledge of Laws, Concepts and proofs related to Electrostatic Fields and Magnetostatic Fields to solve field problems
CO2	Distinguish between the static and time-varying fields and derive the corresponding Maxwell's Equations with Boundary Conditions
CO3	Evaluate wave equations for good Conductors and Dielectrics also develop the power and polarization of waves
CO4	Analyze the uniform plane wave characteristics for propagation in practical mediums

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Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2			1	1	2	1	2	2	
CO2	3	3	2	1	2			1	1	2	1	2	2	
CO3	3	3	2	1	2			1	1	2	1	2	2	
CO4	3	3	2	1	2			1	1	2	1	2	2	
Average* (Rounded to nearest integer)	3	3	2	1	2			1	1	2	1	2	2	

Syllabus

Unit No.	Contents	Mapped CO
I	**Review of coordinate systems; Electrostatics:** Coulomb's Law, Electric Field Intensity, Field due to a line charge, Electric Flux Density, Guass's law, Electric Potential, Potential gradient, energy stored, Laplace's and Poison's equations.	CO1
II	**Magneto-statics:** Steady current, Biot-Savart's law, Static magnetic field due to line current, Magnetic flux Density, Ampere's circuital law, Lorentz force equation, Magnetic Vector Potential, energy stored.	CO1

III	**Time-varying Fields and Maxwell's Equations:** Time varying fields, Faraday's law of electromagnetic induction, Displacement current, Maxwell's equations in point form and integral form, boundary conditions of electromagnetic fields, Polarization, Magnetization.	CO2
IV	**Uniform Plane Wave:** Wave equation, Wave propagation in free space, wave propagation in conductor and dielectrics, Poynting Theorem, skin effect, wave polarization, Direction cosines.	CO3
V	**Plane Waves at Boundaries and in Dispersive Media:** Reflection of uniform plane waves by perfect conductor – normal and oblique incidence, standing wave ratio, Reflection and transmission of uniform plane waves by perfect dielectric – normal and oblique incidence.	CO4

Learning Resources
Text Books
1. E. C. Jordan, EM Waves and Radiating Systems, PHI, 2nd edition,2007 2. William H. Hayt, Engineering Electromagnetics, Tata McGraw Hill Publications
Reference Books
1. R Shevgaonkar, "Electromagnetic Waves ", Tata McGraw Hill Publications 2. Matthew N.O.Sadiku, "Principles of Electromagnetics", Oxford University Press
e- Resources & other digital material
1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013-electromagnetics-and-applications-spring-2009/ 2. https://nptel.ac.in/courses/117/103/117103065/

PVP 19

ANALOG CIRCUITS

Course Code	19EC3403	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Design and analyze feedback amplifiers
CO2	Design and analyze Power amplifiers and oscillators
CO3	Realize linear and non-linear applications using op-amp
CO4	Design and understand various applications related to filter circuits and IC 555
CO5	Compare the performance of various types of ADC and DAC using Op-Amp

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Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3							2	3	2
CO2	3	3	2	2	3							2	3	2
CO3	3	3	2	2	3							2	3	2
CO4	3	3	2	2	3							2	3	2
CO5	3	3	2	2	3							2	3	2
Average* (Rounded to nearest integer)	3	3	2	2	3							2	3	2

Syllabus

Unit No.	Contents	Mapped CO
I	**Feedback Amplifiers:** The general feedback structure, properties of negative feedback, basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, shunt-shunt and shunt-series feedback amplifiers, determining loop gain.	CO1
II	**Oscillators:** Basic principles of sinusoidal oscillators, op amp RC oscillator circuits, LC and crystal oscillators. Power amplifiers: Classification of output stages, class A output stage, class B output stage, class AB output stage, Power Transistors.	CO2
III	**Operational Amplifiers:** The ideal op amp, the inverting and non-inverting configuration, difference and instrumentation amplifiers, summing, scaling and averaging amplifiers, integrators, differentiators, logarithmic amplifiers, V/I and I/V converters, Comparators and waveform generators.	CO3
IV	**IC Timers:** Introduction, operating modes of the 555 timer, terminals of the 555 timer, free running mode and applications. Active Filter Design: LPF, HPF, BPF, BEF, all-pass filters. Voltage reference circuits: Power supplies: ripple removal and regulation.	CO4

V	**Data Converters:** Digital to analog conversion process, voltage output DACs, multiplying DAC, DAC characteristics. Analog to Digital Converters: integrating ADC, successive approximation ADC, Flash converters: Principle of operation, Dual slope ADC, Remote control applications, ADC characteristics.	CO5

Learning Resources
Text Books
1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press, 2013. 2. D Choudhury Roy, Shail B. Jain, Linear Integrated Circuits, New Age International, 2003 3. Ramakanth Gayakward, Op-Amps and Linear Integrated Circuits, 4/e, Pearson Education, 2007
Reference Books
1. Behzad Razavi, Fundamentals of Microelectronics, 2/e, Wiley Student Edition, 2013. 2. R.F Coughlin, F.F Driscoll, Op-Amps and Linear Integrated Circuits, 6/e, Pearson Education, 2008. 3. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata Mc-Graw Hill, 2002.

PVP 19

ANALOG COMMUNICATIONS

Course Code	19EC3404	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Design High Performance AM Radio Receiver System with minimum cost.
CO2	Analyse Complexity involved in DSB, SSB and VSB modulation and demodulation Techniques
CO3	Design low cost FM Transmitter and Receiver Systems used for community service.
CO4	Analyse Noise performance of different Analog modulation Techniques required for specific application
CO5	Analyse different Pulse modulation Techniques

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	2	2	2					1		1	2	1
CO2	3	3	2	2	2					1		1	2	1
CO3	3	3	2	2	2					1		1	2	1
CO4	3	3	2	2	2					1		1	2	1
CO5	3	3	2	2	2					1		1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2					1		1	2	1

Syllabus

Unit No.	Contents	Mapped CO
I	**Amplitude modulation:** Introduction, Block diagram of communication system, Time domain and Frequency domain description of AM, single tone modulation, power relations in AM waves, Generation of AM waves: square law Modulator, Switching modulator. Detection of AM waves: Square law detector, Envelope detector.AM Radio Broadcasting, The Superheterodyne Receiver	CO1
II	**DSBSC modulation :** Time domain and Frequency domain description of DSBSC waves ,Generation of DSBSC Waves: Balanced modulator, Ring modulator, Coherent detection of DSB-SC Modulated waves: COSTAS Loop, Quadrature carrier multiplexing **SSB modulation:** Time domain and Frequency domain description of SSB modulated waves, Generation of SSB waves, Demodulation of SSB waves. **VSB modulation:** Time domain and frequency domain description of VSB modulated waves, Generation of VSB Modulated wave, and	CO2

	Envelope detection of a VSB Wave pulse Carrier. Comparison of AM techniques, Frequency Division Multiplexing	
III	**Angle Modulation :** Basic concepts of Phase and Frequency Modulation, Frequency modulation, Narrow band FM, Wide band FM, Generation of FM waves: Indirect FM, Direct FM, Demodulation of FM waves: Balanced Frequency discriminator, Phase locked loop (First Order). FM Radio Broadcasting, The Super heterodyne Receiver, FM Stereo Multiplexing. Basics of DRM.	CO3
IV	**Noise in Analog modulation :** Signal to Noise Ratios, AM Receiver model, , Signal to Noise Ratios for Coherent Reception, Noise in DSB Receiver, Noise in SSB Receivers, Noise in AM receivers using Envelope Detection ,Threshold Effect, FM Receiver model, Noise in FM receiver, FM Threshold effect, Pre-emphasis and De-emphasis in FM.	CO4
V	**Digital Representation of Analog Signals:** Introduction, The Sampling process, Pulse amplitude modulation and Demodulation, Time Division Multiplexing, Generation and Demodulation of Pulse Width Modulation and Pulse Position Modulation waves ,Comparison between TDM and FDM	CO5

Learning Resources
Text Books
1. Introduction to Analog and Digital Communication System-Simon Haykin, John Wiley and Sons, 3rd Ed., 2009. 2. Fundamentals of Communication Systems - John G. Proakis, Masoud Salehi, PEARSON, 2nd Ed., 2013
Reference Books
1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 3rd Ed.,2007 2. Analog and Digital Communication System-Sam Shanmugam, John Wiley and Sons,3rd Edition,2009
e- Resources & other digital material
1. https://www.youtube.com/playlist?list=PLC7D3EAEFA0CC0420&app=desktop 2. https://nptel.ac.in/courses/108/105/108105159/

PVP 19

ENVIRONMENTAL SCIENCES

Course Code	19MC1401	**Year**	II	**Semester**	II
Course Category	Mandatory course	**Branch**	ECE	**Course Type**	Theory
Credits	0	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	100	**Semester End Evaluation**	0	**Total Marks**	100

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	Develop an awareness and knowledge on natural resource protection.
CO2	Compile for the better future of environment in India which is based on many positive factors like Biodiversity and ecosystems.
CO3	Apply knowledge how to manage the harmful pollutants
CO4	Identify solutions for global environmental problems for sustainable environment.
CO5	Create awareness among the youth on environmental acts; take part in Environment impact assessment and management plans.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2							
CO2	3						2							
CO3	3						2							
CO4	3						2							
CO5	3						2							
Average* (Rounded to nearest integer)	3						2							

Syllabus		
UNIT NO	**Contents**	**Mapped COs**
I	**Introduction To Environment And Natural Resources:** Introduction to environment: Definition scope importance need for public awareness. Natural resources: Renewable and non-renewable resources, natural resources and associated problems. Forest resources: Uses, Reasons for over-exploitation, deforestation effects case studies. Water resources: Use and over – utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Uses, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, Impacts of overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, use of renewable and non-renewable energy sources, case studies.	CO1
II	**Ecosystems And Biodiversity** Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem,	CO2

	Ecological succession. Biogeochemical cycle: Nitrogen, carbon, Phosphorus cycle. Biodiversity: Definition, Levels of biodiversity: genetic, species and ecosystem diversity. Bio-geographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega – diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In–situ and Ex-situ conservation of biodiversity.	
III	**Environmental Pollution and Control** Environmental Pollution: Definition, causes, effects and control measures: Air Pollution, Water pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards, Solid waste Management, e-waste, Pollution case studies.	CO3
IV	**Social Issues and Global Environment Problems and Efforts** From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management, Remote sensing and GIS methods. Environmental ethics: Issues and possible solutions. Green building concept, Environmental Impact Assessment Environmental Management Plan, Climate change: global warming, acid rain, ozone layer depletion.	CO4
V	**Human Population and Environment Legislation** Population growth, Environment and human health. HIV/AIDS,. Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Environmental Protection Act.	CO5

Learning Recourses
Text Books
1. Anubha Kaushik and C.P. Kaushik, Text book of environmental studies New Age International Publisher (2014). 2. Erach Barucha, Text book of environmental studies for undergraduates courses, published by – University Grants Commission, University Press (2005) 3. Anindita Basak, Environmental Studies. Pearson (2009)
Reference Books
1. D.K. Asthana and Meera Asthana, A Text book of Environmental Studies, S. Chand (2010). 2. P.M Cherry Solid and Hazardous waste Management, CBS Publisher (2016). 3. Charles H. Ecclestion, Environmental Impact Assessment, CRC Press (2011).

PVP 19

LIFE SCIENCES FOR ENGINEERS LAB

Course Code	19BS1451	**Year**	II	**Semester**	II
Course Category	Basic Sciences	**Branch**	ECE	**Course Type**	Lab
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Nil
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	Understand basic facts and concepts in life sciences.
CO2	Evaluate and explain different processes in industrial applications
CO3	Summarize the applications of various spheres in life sciences in relevance to future studies
CO4	Develop the ability to apply the principles of Mendalian laws and acquire problem solving skills.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2							
CO2	3						2							
CO3	3						2							
CO4	3						2							
Average* (Rounded to nearest integer)	3						2							

Syllabus		
Expt. No	**Contents**	**Mapped CO**
I	Microscopy	CO1,CO3
II	Dissect & mount different parts of plants using Microscope	CO1,CO3
III	Estimation of Proteins by using Biuret method	CO1,CO2
IV	Estimation of enzyme activity.	CO1,CO2
V	Estimation of chlorophyll content in some selected plants.	CO1,CO3
VI	Nitrogen Cycle: Estimation of Nitrates /Nitrites in soil by using Spectrophotometer	CO2,CO3
VII	Mendal's laws	CO1,CO4
VIII	Solve Problems based on Mapping.	CO2,CO4

Learning Recourses
Text Books
1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018. 2. Arthur T Johnson, Biology for Engineers, CRC press, 2011.
Reference Books
1. Alberts et al., The molecular biology of the cell, 6/e, Garland Science, 2014. 2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009. 3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012.

PVP 19

DIGITAL LOGIC DESIGN LAB

Course Code	19EC3451	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Verify Truth tables of different Logic Gates, Simplify & Implement Boolean Functions in Standard forms
CO2	Realize & Implement different Combinational circuits
CO3	Verify excitation tables of different Flip-flops
CO4	Design & Verify counters using different Flip-flops

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2							1	2	1
CO2	3	3	2	2	2							1	2	1
CO3	3	3	2	2	2							1	2	1
CO4	3	3	2	2	3							1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	3							1	2	1

Syllabus

Expt. No.	Contents	Mapped CO
I	Verification of Truth Tables of Logic gates and implementation of Basic gates using Universal Gates	CO1
II	Implementation of the given Boolean functions using logic gates in both SOP and POS form.	CO1
III	Simplification of the given Boolean function using K-map and implement using logic gates.	CO1
IV	Realization and verification of Full adder and Full Subtractor using logic gates.	CO2
V	Implementation of the given function using decoder and logic gates	CO2
VI	Implementation of the given function using decoder and logic gates.	CO2
VII	Verification of State Tables of SR, D, JK and T-Flip-Flops	CO3
VIII	Design and Verify the operation of 4-bit Synchronous Counter using T flip-flops.	CO4
IX	Design and Verify the operation of 4-bit and Mod-N Ripple Counters using JK flip-flops	CO4
X	Mini Project	CO4

Learning Resources
Text Books
1. Michael D. Ciletti, M. Morris Mano, Digital Design, 4/e. Pearson Education, 2007.

Reference Books
1. Zvi Kohavi, Switching and Finite Automata Theory, 2/e, Tata McGraw-Hill Education, 2008. 2. John F. Wakerly, Digital Design Principles and Practices, 4/e, Pearson Education, 2008. 3. Frederick J. Hill &Gerald R. Peterson, Introduction to Switching Theory and Logic Design 3/e, J.Willey& Sons, 1981. 4. Charles Roth, Jr., Larry Kinney, Fundamentals of Logic Design, 7/e, Cengage Learning, India, 2013.
e- Resources & other digital material
1. http://www.ece.ubc.ca/~saifz/eece256.html 2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Guwahati/digital_circuit/frame/index.html

PVP 19

ANALOG CIRCUITS LAB

Course Code	**19EC3452**	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Design and analyze feedback amplifiers
CO2	Design and analyze Power amplifiers and oscillators
CO3	Realize linear and non-linear applications using op-amp
CO4	Design and understand various applications related to filter circuits and IC 555
CO5	Compare the performance of various types of ADC and DAC using Op-Amp

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Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	3							2	3	2
CO2	3	3	2	2	3							2	3	2
CO3	3	3	2	2	3							2	3	2
CO4	3	3	2	2	3							2	3	2
CO5	3	3	2	2	3							2	3	2
Average* (Rounded to nearest integer)	3	3	2	2	3							2	3	2

Syllabus

Expt. No.	**Contents**	**Mapped CO**
I	Feedback Amplifier - calculation of gain, input resistance, output resistance with and without feedback, frequency response characteristic.	CO1
II	Design and Implementation of Two stage RC Coupled amplifier for given voltage, current gain & bandwidth.	CO1
III	RC phase-shift, Wien bridge, Colpitts Oscillators	CO2
IV	Class A power amplifier.	CO2
V	Class B Push - pull power amplifier.	CO2
VI	Tuned voltage amplifier.	CO2
VII	Analysis and simulation of RC differentiator/integrator	CO3
VIII	Operational Amplifier Circuits (Adders, Integrators, Differentiators, Filters	CO3
IX	Op amp based AM/FM Modulator/Demodulator Circuits.	CO3
X	Bistable/Monstable/Astable multivibrators with 555 timer and using 741	CO4
XI	Active Filter Design (LPF AND BANDPASS types)	CO4
XII	Data Converters	CO5

Learning Resources
Text Books
1. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar, Microelectronic Circuits, 6/e, Oxford University Press, 2013. 2. D Choudhury Roy, Shail B. Jain, Linear Integrated Circuits, New Age International, 2003 3. Ramakanth Gayakward, Op-Amps and Linear Integrated Circuits, 4/e, Pearson Education, 2007
Reference Books
1. Behzad Razavi, Fundamentals of Microelectronics, 2/e, Wiley Student Edition, 2013. 2. R.F Coughlin, F.F Driscoll, Op-Amps and Linear Integrated Circuits, 6/e, Pearson Education, 2008. 3. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata Mc-Graw Hill, 2002.

PVP 19

ANALOG COMMUNICATIONS LAB

Course Code	19EC3453	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Nil
Continuous Internal Evaluation	25	**Semester End Evaluation**	50	**Total Marks**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyze different parameters of Analog modulation techniques
CO2	Analyze different parameters of pulse modulation techniques
CO3	Study various parameters of Radio Receivers.
CO4	Design and Construct Radio Receivers on their own

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2					1		1	2	1
CO2	3	3	2	2	2					1		1	2	1
CO3	3	3	2	2	2					1		1	2	1
CO4	3	3	2	2	2					1		1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2					1		1	2	1

Syllabus

Expt. No.	Contents	Mapped CO
I	Amplitude Modulation and Demodulation using MATLAB	CO1
II	DSBSC Modulation and Demodulation using MATLAB	CO1
III	SSB modulation and Demodulation using MATLAB	CO1
IV	Frequency modulation and Demodulation using MATLAB	CO1
V	Spectral Analysis of AM and FM using Spectrum Analyzer	CO1
VI	Pre-emphasis and De-emphasis	CO1
VII	Time Division multiplexing and de-multiplexing using MATLAB	CO1
VIII	Pulse amplitude modulation and Demodulation using MATLAB	CO2
IX	Pulse Position modulation and Demodulation using MATLAB	CO2
X	AGC Characteristics of Radio Receiver using MATLAB	CO3
XI	Phase Lock Loop using MATLAB	CO3
XII	Design and Construction of FM Radio Receiver	CO4

Learning Resources

Text Books

1. Introduction to Analog and Digital Communication System-Simon Haykin, John Wiley and Sons, 3rd Ed., 2009.
2. Fundamentals of Communication Systems - John G. Proakis, Masoud Salehi, PEARSON, 2nd Ed., 2013

Reference Books

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 3rd Ed.,2007
2. Analog and Digital Communication System-Sam Shanmugam, John Wiley and Sons,3rd Edition,2009

PVP 19

III-YEAR

PVP 19

INTERNET OF THINGS

Course Code	19ES1501	**Year**	III	**Semester**	I
Course Category	Engineering Sciences	**Branch**	All Branches	**Course Type**	Theory
Credits	2	**L-T-P**	2-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Summarize the genesis and impact of IoT applications, architectures in real world. (L2).
CO2	Illustrate diverse methods of deploying smart objects and connect them to network (L3).
CO3	Construct simple applications using Arduino. (L3).
CO4	Interpret different protocols and select which protocol can be used for a specific application (L2).
CO5	Identify and develop a solution for a given application using APIs (L3).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
*** - Average value indicates course correlation strength with mapped PO**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2	2	2	3	3					2	3	3
CO2	2		2	2	2	3	3					2	3	3
CO3	2	3	2	2	3	3	3					2	3	3
CO4	3	3	3	3			2					2	3	3
CO5	3	3	3	3	3	3	2	2			3	3	3	3
Average* (Rounded to nearest integer)	3	3	3	3	3	3	3	2			3	3	3	3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	CO1
II	Smart Objects: The Things in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	CO2
III	Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness	CO3
IV	Communication in the IoT: Internet Principles, Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports,	CO4

	Application Layer Protocols HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.	
V	Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.	CO5

Learning Resources

Text Books

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Thing Wiley Publications, 2012.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

Reference Books

1. Arshdeep Bahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014
2. Srinivasa K G, Internet of Things, CENGAGE Leaning India, 2017

PVP 19

ANTENNA ANALYSIS AND SYNTHESIS

Course Code	19EC3501	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	EMW
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret the fundamental parameters of antennas in order to construct a wireless communication link. L2
CO2	Analyse various wire antennas and establish their mathematical relations. L4
CO3	Develop antennas for different frequency ranges and analyse radiation properties L3
CO4	Construct and analyse antenna arrays and synthesize the arrays L4

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	3	2	2	2	1	1					1	1	2	3
CO2	3	3	3	2	2	1					1	1	2	3
CO3	3	3	3	2	3	1					1	1	2	3
CO4	3	3	3	3	3	1					1	1	2	3
Average* (Rounded to nearest integer)	3	3	3	3	3	1					1	1	2	3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Antenna Basics:** Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem	CO1
II	**Thin Linear Wire Antennas** – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).	CO1, CO2

III	**VHF, UHF and Microwave Antennas - I**: Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns.	CO1, CO3
IV	**VHF, UHF and Microwave Antennas - II**: Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern characteristics, Feed Methods, Reflector Types – Related Features.	CO1, CO3
V	**Antenna Arrays:** Point Sources – Definition, Patterns**,** arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays. **Antenna Synthesis:** Introduction, Continuous Sources, Schelkunoff Polynomial Method and Fourier transform Method.	CO1, CO3 CO4

Learning Resources

Text Books

1. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan,
   TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
2. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.

Reference Books

1. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/105/108105114/

2. https://nptel.ac.in/courses/108/105/108105114/

PVP 19

DIGITAL COMMUNICATIONS

Course Code	19EC4501A	**Year**	III	**Semester**	I
Course Category	Program Elective - I	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Construct different Baseband Digital Systems. (L3)
CO2	Analyze different parameters of digital Pass-band modulation Techniques. (L4)
CO3	Analyze different parameters in Spread Spectrum modulation Techniques. (L4)
CO4	Develop various Source Coding techniques.(L3)
CO5	Build Coding sequences for different error correcting codes.(L3)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2:Medium, 1:Low)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2					1		2	2	1
CO2	3	3	3	2	2					1		2	2	1
CO3	3	3	2	2	2					1		2	2	1
CO4	3	3	3	2	2					1		2	2	1
CO5	3	3	2	2	2					1		2	2	1
Average* (Rounded to nearest integer)	3	3	3	2	2					1		2	2	1

Syllabus

Unit No.	Contents	Mapped CO
I	**Waveform Coding Techniques:** Introduction, Pulse code modulation (PCM), Delta modulation, Adaptive delta modulation, Differential Pulse Code Modulation (DPCM), output Signal to quantization Noise ratio in PCM and DM systems. **Base band Pulse Transmission**: Inter symbol interference, Nyquist's Criterion for Distortion less Baseband Binary Transmission, Correlative coding.	CO1
II	**Signal Space Analysis:** Introduction, Gram Schmidt Orthogonalization procedure, Geometric interpretation of signals, Coherent detection of signals in noise, Probability of error, Correlation receiver, Matched filter, Properties. **Digital Modulation Techniques:** Coherent Phase Shift Keying, Coherent Frequency Shift Keying, Quadrature Phase Shift Keying, Non Coherent Frequency Shift Keying, Differential Phase Shift keying.	CO2

III	Spread-Spectrum Modulation: Introduction, Pseudo-Noise Sequences, Direct sequence spread spectrum, Processing Gain, Probability of Error, Antijam Characteristics, Frequency- Hop Spread spectrum, Slow frequency Hopping, Fast Frequency Hopping	CO3
IV	Information Theory: Introduction, information, Entropy, Source Coding Theorem, Data Compaction, Shannon-Fano coding, Huffman coding, Lempel-Ziv Coding, Discrete memory less channels, Mutual information, channel coding Theorem, Differential Entropy , Information Capacity Theorem and its implications.	CO4
V	Error Control Coding: Introduction, Linear Block codes, Syndrome and its Properties, Syndrome Decoding, Cyclic Codes, Encoder, Syndrome calculator, Convolutional Codes, Code Tree, Trellis and State Diagram.	CO5

Learning Resources
Text Books
1. Digital communications, Simon Haykin, John Wiley, 4th Edition 2010 2. Digital Communications–John Proakis, TMH, 3rd Edition, 1995
Reference Books
1. Digital and Analog Communication Systems – Sam Shanmugam, John Wiley, 1979 2. Communication systems–AB Carlson, McGraw-Hill,4th Edition, 2002 3. Principles of Communication Systems–H.Taub , D.Schilling, TMH, 3rd Edition, 2008 4. Digital communications –B Sklar, Pearson Education, 2nd Edition, 2013
e-Resources & other digital material
1. http://www.ece.utah.edu/~npatwari/ece5520/lectureAll.pdf 2. http://nptel.iitm.ac.in/syllabus/syllabus.php?subjectId=117105077

PVP 19

DSP PROCESSORS AND APPLICATIONS

Course Code	19EC4501B	Year	III	Semester	I
Course Category	Program Elective - I	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Develop the Computational Accuracies in DSP implementation. (L3)
CO2	Demonstrate Architectures for different DSP devices. (L2)
CO3	Evaluate different pipelining concepts. (L5)
CO4	Classify different DSP Processors.(L4)
CO5	Interpret different DSP algorithms. (L2)

Contribution of Course Out comes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1: Low)														
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	2							2	2	1
CO2	3	3	3	2	2							2	2	1
CO3	3	3	2	2	2							2	2	1
CO4	3	3	3	2	2							2	2	1
CO5	3	3	2	2	2							2	2	1
Average* (Rounded to nearest integer)	3	3	3	2	2							2	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Computational Accuracy in DSP Implementations:** Number formats for signals and coefficients in DSP systems, dynamic range and precision, sources of error in DSP implementations, A/D conversion errors, DSP computational errors, D/A conversion errors, compensating filter.	CO1
II	**Architectures for Programmable DSP Devices:** Basic architectural features, DSP computational building blocks, bus architecture and memory, data addressing capabilities, address generation unit, programmability and program execution, speed issues, features for external interfacing.	CO2
III	**Execution Control and Pipelining:** Hardware looping, interrupts, stacks, relative branch support, pipelining and performance, pipeline depth, interlocking, branching effects, interrupt effects, pipeline programming models	CO3

IV	**Programmable Digital Signal Processors:** Commercial digital signal processing devices, data addressing modes of TMS320C54XX processors, memory space, program control, instructions and programming, on-chip peripherals, interrupts and pipeline operation of TMS320C54XX processors.	CO4
V	**Implementations of Basic DSP Algorithms & Interfacing:** The Q-notation, FIR Filters, IIR Filters, interpolation filters, decimation filters, Computation of the signal spectrum, Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).	CO5

Learning Resources
Text Books
1. Avtar Singh, S.Srinivasan, Digital Signal Processing, Cengage Learning, 2004. 2. Phil Lapsley, DSP Processor Fundamentals: Architectures and Features, IEEE Press, 1997.
Reference Books
1. Sen M.Kuo, Real-Time Digital Signal Processing, 2/e, Wiley Student Edition, 2010. 2. B.Venkata Ramani, M.Bhaskar, Digital Signal Processors, Architecture, Programming and Applications, Tata McGraw Hill, 2004. 3. 3.Jonatham Stein, Digital Signal Processing, Wiley Student Edition, 2005

PVP 19

DIGITAL SYSTEM DESIGN

Course Code	19EC4501C	**Year**	III	**Semester**	I
Course Category	Program Elective-I	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Digital Logic Design
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand Memories and Programmable Logic Devices (L2).
CO2	Analyze algorithmic state machines and asynchronous sequential circuits (L4).
CO3	Design logic gates using different logic families(L5)
CO4	Impart the basics of functional verification languages (L2)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	3		3		3					3			3	
CO2	3		3		3					3			3	
CO3	3	3								3			3	
CO4	3	3								3			3	
Average* (Rounded to nearest integer)	3	3	3	3	3					3			3	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	MEMORY AND PROGRAMMABLE LOGIC: Introduction, Random Access Memory, Memory Decoding, Error Detection and Correction, Read-Only Memory, Programmable Logic Array, Programmable Array Logic.	CO1
II	DESIGN AT THE REGISTER TRANSFER LEVEL: Introduction, Register Transfer Level (RTL) Notation, RTL Descriptions, Algorithmic State Machines(ASMs), Design Example (ASMD CHART), HDL Description of Design Example, Sequential Binary Multiplier, Control Logic, HDL Description of Binary Multiplier, Design with Multiplexers, Race-Free Design, Latch-Free Design.	CO2
III	ASYNCHRONOUS SEQUENTIAL LOGIC: Introduction, Analysis Procedure, Circuits with Latches, Design Procedure, Reduction of state and flow tables, Hazards, Design Example.	CO2

IV	DIGITAL INTEGRATED CIRCUITS: Introduction, Special Characteristics, Bipolar-Transistor Characteristics, RTL and DTL circuits, Transistor-Transistor Logic, Emitter Coupled Logic, Metal-Oxide Semiconductor, Complementary MOS, CMOS Transmission Gate circuits.	CO3
V	SYSTEM VERILOG INTRODUCTION: System Verilog Origins-The Accellera System Verilog Standard, Donations to System Verilog, Key System Verilog enhancements for hardware design.	CO4

Learning Resources
Text Books
1. Digital Design-M. Morris Mano, Michael D.Ciletti- 6th Edition, Pearson Publishers 2. System Verilog for Design- Stuart Sutherland, Simon Davidmann, Peter Flake
Reference Books
1. Digital Design- John F.Wakerly- 4th Edition, PHI

PVP 19

TRANSMISSION LINES AND WAVEGUIDES

Course Code	19EC4501D	**Year**	III	**Semester**	I
Course Category	Programme Elective-I	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret the parameters of different transmission lines for various applications (L2)
CO2	Develop transmission lines for applications in different frequency ranges (L3)
CO3	Analyse transmission line parameters using different tools (L4)
CO4	Analyse rectangular waveguides and cavity resonators for EM wave propagation (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	1								1	2
CO2	2	3	3	2	1								2	2
CO3	3	3	1	2	2								2	2
CO4	2	2	2	3	2								3	2
Average* (Rounded to nearest integer)	3	3	2	3	2								2	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Basics of Transmission Lines**: Concept and definition, Different kinds of transmission lines, Applications, Equivalent circuit, Primary constants- R, L, C and G, Secondary constants – Propagation constant and Characteristic Impedance, General transmission line equations. Attenuation and phase constant. Wavelength, phase velocity and group velocity. Time domain transmission line equations. The lossless transmission line, The infinite long transmission line, The distortion less transmission line and condition for distortion less ness and minimum attenuation, The low resistance transmission line. Loading, Types of loading, Losses.	CO1
II	**Finite Transmission Lines**: The load reflection coefficient, Standing Wave Ratio, Line impedance, Generalized reflection coefficient, The lossless terminated transmission line, The lossless matched transmission line, The lossless shorted transmission line, The lossless open transmission line, The lossless resistively loaded transmission line. Power relations on a general transmission line.	CO2

III	**UHF Lines**: UHF lines as circuit elements: λ/4, λ/2, λ/8 lines, **Smith Chart**: Construction of smith chart, Smith chart as impedance chart, smith chart as admittance chart, Problems using smith chart. Impedance matching- Single stub with applications, Quarter wave transformer.	**CO2, CO3**
IV	**Waveguides:** Introduction, Rectangular Waveguides-Transverse Electric (TE) and Transverse Magnetic (TM) mode analysis – Field expressions, Characteristic equation, Cut-off frequency, Phase velocity, Group velocity, Attenuation and Phase constants, Wavelength and Impedance. Filter characteristics, Dominant and degenerate modes, Mode dispersion, Power transmission and Power loss expressions. **Cavities:** Rectangular Cavity Resonators-Dominant modes and Resonant Frequencies, Q factor, Types of coupling and Coupling coefficients.	**CO4**
V	**Strip Lines**: Introduction, Microstrip Lines- characteristic impedance, Losses and Quality factor. Parallel Strip Lines- distributed parameters, characteristic impedance, attenuation losses. Coplanar Strip Lines, Shielded Strip Lines.	**CO1**

Learning Resources

Text Books

1. Engineering Electromagnetics, Nathan Ida, Springer International, 2nd Edition 2008.
2. Microwave Devices and Circuits – Samuel Y. Liao, Pearson Education, 3rd Edition, 2003.

Reference Books

1. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2009
2. 2. Annapurna Das, Sisir K Das, "Microwave Engineering", 2nd edition, 2006, Tata McGraw Hill.

e- Resources & other digital material

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/em/index.htm
2. http://nptel.iitm.ac.in/video.php?subjectId=117101056
3. http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Transmission %20Lines %20and%20EM%20Waves/TOC.htm
4. http://www.mike-willis.com/Tutorial/PF2.htm

PVP 19

COMPUTER ORGANIZATION AND DESIGN

Course Code	19EC4501E	**Year**	III	**Semester**	I
Course Category	Program Elective-1	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Know the functional unit of the processor such as the register file and arithmetic logical unit and with the basic of system topic (L2)
CO2	Outline the sequence of instruction execution, concept of pipelining, and modes of data transfer. Analyse the CPU design including the RISC/CISC architectures (L3)
CO3	Demonstrate the basic knowledge of I/O devices and interfacing of I/O devices. (L2)
CO4	Analyse various issues related to memory hierarchy (L3)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3										3	
CO2	3	3	3										3	
CO3	3	3	3										3	
CO4	3	3	3										3	
Average* (Rounded to nearest integer)	3	3	3										3	

Unit No.	**Contents**	**Mapped CO**
I	**Register Transfer and Micro operations:** Register transfer language, register transfer, bus and memory transfer, arithmetic micro operations, logic micro operations, shift micro operations, arithmetic logic shift unit.	CO1
II	**Computer Description:** Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory-reference instructions, input-output and interrupt.	CO2
III	**Micro programmed Control:** Control memory, address sequencing. Central Processing Unit: General register organization, stack organization, addressing modes, reduced instruction set computer (RISC).	CO2, CO3

IV	**Input-Output Organization:** Peripheral devices, input-output interface, modes of data transfer, direct memory access.	CO1,CO3
V	**Memory Organization:** Memory hierarchy, main memory, cache memory, virtual memory.	CO1, CO4

Learning Resources
Text Books
1. Morris Mano, Computer System Architecture, 3/e, Pearson Education, 2000.
Reference Books
1. William Stallings, Computer Organization and Architecture, 6/e, Pearson Education Asia, 2000. 2. David A. Patterson, John L. Hennessy, Computer Organization and Design: The hardware / software interface, 3/e, Morgan Kaufmann, 2002. 3. John P. Hayes, Computer Architecture and Organization, 3/e, McGraw-Hill, 1998.
e- Resources & other digital material
1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IITKANPUR/Comp Architecture/page1.htm 2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT20Guwahati/comp_org_arc/web/index.htm 3. http://williamstallings.com/COA5e.html

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PVP 19

WIRELESS SENSOR NETWORKS AND IOT

Course Code	19EC4501F	**Year**	III	**Semester**	I
Course Category	Elective -I	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyse various WSN of Architectures, Protocols, and IOT Network Architecture and Design, (L4).
CO2	Analyse various WSN of Architectures, Protocols. (L4).
CO3	Design and Analyse IOT Network Architectures (L5).
CO4	Evaluate and Designing protocols for Wireless Networks and IOT Network Architectures (L5).
CO5	Design protocols for Ad Hoc Wireless Networks (L5).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2		3		2			2	2	2	3
CO2	3	3	2	2		3		2			2	2	2	3
CO3	3	3	2	2		3		2			2	2	2	3
CO4	3	3	2	2		3		2			2	2	2	3
CO5	3	3	2	2		3		2			2	2	2	3
Average* (Rounded to nearest integer)	3	3	2	2		3		2			2	2	2	3

Syllabus

Unit No.	Contents	Mapped CO
I	**Introduction:** Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints an challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.	CO1 ,CO4
II	**Architectures:** Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Optimisation Goals and Figures of Merit, Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs	CO1,CO2 ,CO4
III	**Protocols:** Issues in Designing MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks and Classifications of MAC Protocols. Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols	CO1,CO2, CO4,CO5

IV	Genesis of IoT, IoT and Digitization, Connected Roadways, Connected Factory, Smart Connected Buildings, Smart creatures, Convergence of IT and OT, IoT Challenges	CO1,CO3, CO4
V	IoT Network Architecture and Design, IoT Architectural Drivers, The oneM2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, Things: Sensors and Actuators Layer, Communications Network Layer, Applications and Analytics Layer, IoT Data Management and Compute Stack, Edge, Fog, and Cloud computing	CO1,CO3, CO4

Learning Resources
Text Books
1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005. 2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007. 3. IoT Fundamentals Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Jerome Henry, Robert Barton by Cisco Press, 2017
Reference Books
1. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, Wireless Sensor Network, Springer 1/e, 2004 (ISBN: 978, 4020, 7883, 5). 2. Ian F. Akyildiz and Mehmet Can Vuran, Wireless Sensor Networks, John Wiley and Sond Ltd, Publication, 2010
e- Resources & other digital material
1.https://www.ipwea.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=e0619c58-f639-080a-86c2-055ae9c8af4d 2.http://www.infocobuild.com/education/audio-video-courses/computer-science/IntroductionToIoT-IIT-Kharagpur/lecture-18.html

PVP 19

DIGITAL SIGNAL PROCESSING

Course Code	19EC3502	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Signals and Systems
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret discrete-time signals and systems using Z-transform, DFT & FFT (L2).
CO2	Build IIR systems in Direct, Cascade and Parallel form structures (L3).
CO3	Apply FFT algorithms for various signal processing operations (L3).
CO4	Analyse frequency response and impulse response of discrete-time LTI systems (L4).
CO5	Design IIR and FIR digital filters for the given specifications (L5).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	2							1	2	1
CO2	3	3	3	2	2							1	2	1
CO3	3	3	2	2	2							1	2	1
CO4	3	3	3	2	2							1	2	1
CO5	3	3	2	2	2							1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2							1	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Transform Analysis of Discrete time LTI Systems**: Frequency response of LTI systems, System functions of LTI systems characterized by linear constant coefficient difference equations: Stability, Causality, Impulse response for rational system functions, Structures for IIR Discrete-Time Systems: Direct, Cascade and Parallel forms.	CO1, CO2, CO4
II	**The Discrete Fourier Transform (DFT)**: Introduction to Discrete Fourier Transform, Computation of DFT, Properties of DFT, Circular convolution, Linear convolution using DFT, Overlap-add method, Overlap-save method.	CO1, CO4
III	**Fast Fourier Transform (FFT)**: Introduction, Radix-2 Decimation-in-time FFT algorithm, Radix-2 Decimation-in-frequency FFT algorithm, Inverse DFT using FFT algorithms.	CO1, CO3

IV	**Design of IIR Digital Filters**: Design of analog prototypes from digital filter specifications using Butterworth and Chebyshev approximations, Design of IIR filters from analog filters: Butterworth filter and Chebyshev filter design using Impulse Invariance Method, Bilinear Transformation Method.	CO1, CO4, CO5
V	**Design of FIR Digital Filters**: Linear discrete time systems with generalized linear phase, Design of linear phase FIR filters using Window functions (Rectangular, Hamming, Hanning, Blackman and Kaiser), Frequency Sampling technique.	CO1, CO4, CO5

Learning Resources
Text Books
1. J.G.Proakis and D.G.Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4/e, Pearson Education, 2007. 2. Fundamentals of Digital Signal Processing - Lonnie C Ludeman, John Wiley & Sons, 2003
Reference Books
1. A.V.Oppenheim, R.W.Schafer, Discrete-Time Signal Processing, 3/e, Prentice Hall of India, 2009. 2. Digital Signal Processing "A – Computer Based Approach" - Sanjit K Mitra, Tata Mc Graw Hill 2nd Edition, 2003
e- Resources & other digital material
1. http://www.nptel.iitm.ac.in/ 2. http://www.ee.umanitoba.ca/~moussavi/dsp815/LectureNotes/index.html 3. http://www.ece.cmu.edu/~ee791 4. 4. http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/notes.html

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PVP 19

CONTROL SYSTEMS ENGINEERING

Course Code	19EC3503	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Classify** control systems and represent in various models (L2)
CO2	**Apply** standard test signals to a system to determine their characteristics (L3)
CO3	**Make use of** stability concepts to obtain the desired characteristics (L3)
CO4	**Determine** the characteristics of a linear control system using various time and frequency domain tools (L5)
CO5	**Examine** the system behaviour using various stability analysis techniques (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2			1	1	1		1	2	1
CO2	3	3	2	2	2			1	1	1		1	2	1
CO3	3	3	2	2	2			1	1	1		1	2	1
CO4	3	3	2	2	2			1	1	1		1	2	1
CO5	3	3	2	2	2			1	1	1		1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2			1	1	1		1	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction:** Concepts of control systems. Examples of control systems, classification of control systems, Block diagram algebra, Representation by Signal flow graph. Reduction using Mason's gain formula. Feedback Characteristics, Effects of feedback. Mathematical modelling of systems – Electrical, mechanical translational and rotational systems.	CO1
II	**Time Domain Analysis:** Standard test signals, Time response of first and second order systems with standard input signals, Time domain specifications, steady state error and error constants. Effects of P, PI, PD and PID Controllers.	CO2, CO3

III	**Stability Analysis in S-Domain:** Concept of stability, Routh Hurwitz criterion. Construction of Root locus. Effects of adding poles and zeros to open loop transfer function on the root loci.	CO3,CO4 ,CO5
IV	**Frequency Response Analysis:** Correlation between time and frequency responses. Determination of frequency domain specifications, Gain margin and Phase margin -Stability Analysis from Bode Plots, Polar plots and Nyquist plots.	CO3CO4, CO5
V	**State variable analysis:** State, State variables, State variable representation, State variable form from Transfer function (Diagonal form), transfer function from State variable form, State transition matrix, properties of state transition matrix, Controllability and Observability.	CO1

Learning Resources
Text Books
1. M.Gopal, "Control Systems Engineering" , 3/e , Wiley Eastern Ltd., TMH ,2008 2. Benjamin C.Kuo, "Automatic Control Systems" ,7/e , Prentice Hall of India, 1997.
Reference Books
1. Ogata, "Modern Control Engineering" , 2/e, Prentice Hall of India.,2011 2. R.C. Sukla, "Control Systems", 3/e, Dhanpatrai and Sons,1998 3. Control Systems Engg. , Nise– John wiley , 3rd Edition 2000
e- Resources & other digital material
1. https://nptel.ac.in/courses/108/106/108106098/ 2. https://freevideolectures.com/course/2337/control-engineering

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PVP 19

DATABASE MANAGEMENT SYSTEMS

Course Code	19CS2501A	**Year**	III	**Semester**	I
Course Category	**IDE-1**	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	--
Continuous Internal Evaluation :	30	**Semester En Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon Successful completion of course, the student will be able to		**Blooms Taxonomy Level**
CO1	Understand the basic concepts of database management systems	L2
CO2	Understand normalization techniques with simple examples.	L2
CO3	Apply SQL commands to create tables for a given database application	L3
CO4	Apply ER Model concepts to draw ER Diagrams for a given database application and make an effective report.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3													
CO2	3													
CO3	3													
CO4	3								3	3				
Average* (Rounded to nearest integer)	3								3	3				

SYLLABUS		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to Databases:** Characteristics of the Database Approach, Advantages of using the DBMS Approach, A Brief History of Database Applications. **Overview of Database Languages and Architectures:** Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, Database System environment, Centralized and Client-Server Architecture for DBMS.	CO1
II	**Relational Model:** The Relational Model Concepts, Relational Model Constraints and Relational Database Schemas. **SQL:** Data Definition, Constraints, Basic Queries and Updates, Views(Virtual Tables) in SQL	CO3

III	**Conceptual Data Modeling :** High-Level Conceptual Data Models for Database Design, A Sample Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types. **ER-Diagrams:** Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues	CO4
IV	**Database Design Theory**: Functional Dependencies, Normal forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form.	CO2
V	**Transaction Processing**: Introduction, Transaction and System Concepts, Desirable Properties of Transactions. **Introduction to Protocols for Concurrency Control in Databases:** Two-Phase Locking Techniques for Concurrency Control - Types of Locks and System Lock Tables.	CO1

Learning Resources
Text books
1. DATABASE SYSTEMS Models, Languages, Design and Application Programming, Ramez Elmasri, Shamkant B.Navathe, 6th Edition, Pearson.
References
1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, 3rd Edition, TMH. 2. Data base System Concepts, Abraham Silberschatz, Henry F Korth, S.Sudarshan, 5th Edition, McGraw Hill.

PVP 19

QUANTITATIVE TECHNIQUES FOR MANAGEMENT

Course Code	19HS2501A	**Year**	III	**Semester**	I
Course Category	IDE-I	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to -	
CO1	**Understand** the basic concepts for solutions to business problems (L2)
CO2	**Apply** the analytical techniques in business transactions that would help in making effective business decisions (L3)
CO3	**Analyze** problems in business transactions that would help in making effective business (L4)
CO4	**Apply** the least square technique to find the equation of the curve. (L3)
CO5	**Determine** the equation of the curve from the given data. (L4)
CO6	**Apply** the various methods to find the deviations and **submit a report (L3)**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													2	
CO2	3												2	
CO3		3											2	
CO4	3												2	
CO5		3							2	2			2	
Average* (Rounded to nearest integer)	3	3							2	2			2	

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Statistics:** Meaning, Definition, Functions, Importance, Limitations of Statistics, Collection of Primary and Secondary Data.	CO1,CO2, CO3
II	**Measures of Central Tendency:** Definition, Objectives, Characteristics and Techniques: Mean Median, Mode, Geometric Mean and Harmonic Mean.	
III	**Measures of dispersion**: Definition, Objectives, Characteristics and Techniques: Range, Quartile Deviation, Mean Deviation, Standard Deviation and Coefficient of Variation.	
IV	**Measures of Skewness & Kurtosis**: Definition, types of skewness, types of kurtosis, Karl-Pearson's Co-efficient, Bowley's Co-efficient, Kelly Co-efficient, Calculation of Raw Moments and Central Moments	
V	**Curve Fitting:** Method of least squares, straight line, parabola, exponential curve, power curve	CO1,CO4, CO5

Learning Resources
Text Books:
1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012. 2. Dr.T.K.V. Iyengar, Dr.B.Krishna Gandhi, S. Ranganatham, Dr. M.V.S.S.N. Prasad, "Probability & Statistics", Publications: S.Chand, 4th Revised Edition, 2012.
Reference Books:
1. S. Ross, a First Course in Probability, Pearson Education India, 2002. 2. Miller and Freunds, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
e- Resources & other digital material:
1. www.nptelvideos.com/mathematics/(Math Lectures from MIT, Stanford, IIT'S 2. nptel.ac.in/courses/111/106/111106150/ 3. nptel.ac.in/courses/111105035

PVP 19

OOP with C++

Course Code	19IT2501A	**Year**	III	**Semester**	I
Course Category	**IDE-1**	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	C Language
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon Successful completion of course, the student will be able to		**Blooms Taxonomy Level**
CO1	Illustrate the fundamental programming concepts in C++	L2
CO2	Demonstrate the concepts of Object Oriented Programming	L2
CO3	Outline the concepts of polymorphism and Exception handling in C++	L2
CO4	Make use of OOP concepts to develop C++ programs.	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

* - Average value indicates course correlation strength with mapped PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2					1	1				2	2
CO2	2	2	2					1	1				2	2
CO3	2	2	2					1	1				2	2
CO4	2	2	2					1	1				2	2
Average* (Rounded to nearest integer)	2	2	2					1	1				2	2

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to C++:** Difference between C and C++, Evaluation of C++, Programming Paradigms, Key concepts of OOP, Advantages of OOP. **Declarations: Tokens**, Variable declaration and initialization, Data types in C++, Operators in C++, Scope access operator, Name Space, Memory management operators, Comments. **Decision Statements :** Introduction, The if statement, Multiple ifs, Nested if-else, else-if ladder, unconditional control transfer statements, the switch statement	CO1, CO2
II	**Control Loop Structures** : Introduction, What is loop, The for loop, the while loop, The do-while loop **Functions in C++**: Introduction, Parts of a function, Passing arguments, Inline functions, Function overloading **Input and Output in C++:** Streams in C++ and Stream Classes, Pre-defined streams.	CO1, CO2

III	**Classes and Objects**: Introduction, Structure in C, Classes in C++, declaring Objects, Access specifiers and their scope, Defining member functions, Characteristics of member functions, Outside member function as inline, Rules for inline functions, Static member variable, static member functions, friend functions. **Constructors and Destructors**: Introduction, Constructors and destructors, Constructors with default arguments, Parameterized constructor, Overloading constructors, Array of objects using constructors, Constructors with default arguments **Operator Overloading:** Introduction, The keyword operator, Overloading unary operators, Overloading binary operator.	CO2, CO4
IV	**Inheritance**: Introduction, Reusability, Access Specifies and Simple inheritance, Types of inheritance, Single, Multiple, Hierarchical, Hybrid, Multipath inheritances, Virtual base classes, program on simple inheritance **Pointers**: Introduction, Features of pointers, Pointer Declaration, void pointer, wild pointer, The this pointer, Pointers to derived class and base class	CO2, CO4
V	**Binding and Polymorphism and Virtual Functions**: Introduction, Binding in C++, Pointer to base class and derived class objects, Virtual functions, pure virtual functions, Abstract classes. **Exception Handling**: Introduction, Principles of exception handling, the keywords try, throw and catch, Multiple catch statements, Re-throwing an exception.	CO3

Learning Recourses
Text Books
1. Programming in C++, Second Edition, by Ashok N Kamthane, Pearson Education.
References
1. C++ How to Program, Dietel and Dietel, Prentice Hal. 2. C++ The Complete Reference, 5th Edition, by Herbert Schildt, TMH.
E-Recourses and other Digital Material
1. http://www.cplusplus.com 2. https://www.w3schools.com/cpp/

PVP 19

COMPUTATIONAL METHODS

Course Code	19ME2501A	**Year**	III	**Semester**	I
Course Category	IDE-I	**Branch**	**ECE**	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation**:	70	**Total Marks:**	100

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	Solve System of equations using direct and iterative methods
CO2	Solve Boundary and characteristic Value Problems
CO3	Approximate linear and nonlinear curve using regression analysis
CO4	Find a numerical solution to partial differential equations
CO5	Apply finite difference scheme to solve parabolic and hyperbolic partial differential equations

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2										2	2	
CO2	3	2										2	2	
CO3	3	2										2	2	
CO4	3	2										2	2	
CO5	3	2										2	2	
Average* (Rounded to nearest integer)	3	2										2	2	

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to numerical methods applied to engineering problems:** Examples, solving Sets of equations– Matrix notation– Determinants and inversion– Iterative methods–Relaxation methods– Systems of non-linear equations.	CO1
II	**Boundary value problems and characteristic value problems:** Shooting method– Solution through a set of equations –Derivative boundary conditions– Characteristic value problems.	CO2
III	**Curve fitting and approximation of functions:** Least square approximation fitting of non- linear curves by least squares –regression analysis- multiple linear regression, non-linear regression.	CO3
IV	**Numerical solutions of partial differential equations:** Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – Poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grid.	CO4

V	**Parabolic partial differential equations:** Explicit method– Crank-Nicolson method– Derivative boundary condition–Stability and convergence criteria. **Hyperbolic partial differential equations:** Solving wave equation by finite differences- stability of numerical method–method of characteristics-wave equation in two space dimensions.	CO5

Learning Resources
Text Book(s)
1. Steven C.Chapra, Raymond P.Canale, "Numerical Methods for Engineers", Tata Mc- Graw hill,, Fifth edition. 2. Curtis F.Gerald, Partick.O.Wheatley, "Applied numerical analysis" Pearson Education –Sixth Edition.2002
Reference Book(s)
1. Ward cheney & David Kincaid "Numerical mathematics and computing" Brooks/ cole publishing company 1999, fourth edition. 2.Riley K.F.M.P.Hobson & Bence S.J, "mathematical methods for physics and engineering" Cambridge university press, 1999.
e- Resources & other digital material
1. https://www.nptel.ac.in/courses/111/107/111107105/ 2. https://www.nptel.ac.in/courses/111/105/111105041/ 3. https://www.nptel.ac.in/courses/111/106/111106112/ 4. https://www.nptel.ac.in/courses/111/105/111105090/

PVP 19

BIOTECHNOLOGY AND SOCIETY

Course Code	19ES5501A	**Year**	III	**Semester**	I
Course Category	Open Elective I	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understanding the basic concepts of advanced and emerging issues in biotechnology (L2)
CO2	Analyze, and evaluate social and ethical issues in the conduct of biological research and application of biological knowledge (L4)
CO3	Apply knowledge and analytical approaches in several major domains of the biological sciences that reflects a breadth and depth of understanding (L3)
CO4	Analyze the scientific method by formulating hypotheses, proposing testable predictions and then testing to reach supportable conclusions about biological processes and systems, and articulate the relevance of modern biology to society (L4)
CO5	Apply responsibilities to promote societal health and safety, upholding the trust given to the profession by the society (L3)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3					3		3						
CO3	3					3								
CO4						3								
CO5						3	3							
Average* (Rounded to nearest integer)	3					3	3	3						

UNIT NO	**Contents**	**Mapped CO**
I	History of Biotechnology, Genes (basic concepts), Genetic engineering, Tools for manipulation of genes (introduction to recombinant DNA technology), Vectors and expression systems (introduction)	CO1 CO2
II	Intellectual property rights (concepts related to drugs, genes and genomes) Recombinant DNA Debates, Biotechnology and Business, Patenting Life, Genetically Modified Foods: Risk, Regulation, and Our Food	CO1 CO2

III	Freezing, Banking, Crossing, Eugenics, The Human Genome Project, Genetic Testing, Disability, and Discrimination, Bioethics and Medicine, From the Pill to IVF, Cloning, Stem Cells.	CO2 CO3
IV	Drugs and Designer Bodies, Biotechnology and Race, Bio prospecting and Bio colonialism	CO3 CO4
V	Vaccines, Gene therapy, Clinical trials, Synthetic Biology and Bioterrorism, Use of bio fertilisers and bio pesticides for organic farming	CO4 CO5

Learning Resources

Text books

1. Biotechnology and Society: An introduction. Hallam Stevens. University of Chicago Press. 2016. ISBN 022604615X, 9780226046150

References

1. W. Godbey, an Introduction to Biotechnology, The Science, Technology and Medical Applications, 1/e, Woodhead Publishing, 2014.
2. J.M. Walker and R. Rapley, Molecular Biology and Biotechnology, 5/e, Royal society of chemistry, 2009.
3. B.R.Glick, J.J.Pasternak, C.L.Patten. Molecular Biotechnology.ASM Press. 2009. ISBN-10:1555814980, ISBN-13: 978-1555814984s

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ELECTRICAL SAFETY

Course Code	19ES5501B	**Year**	III	**Semester**	I
Course Category	Open Elective I	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the Indian power sector organization and Electricity rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers.(L2)
CO2	Outline the electrical safety during installation, testing and commissioning procedure.(L2)
CO3	Make use of specification of electrical plants and classification of safety equipment for various hazardous locations.(L3)
CO4	Distinguish various fire extinguishers and their classification.(L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	3		2		1	2		2			1		2	1
CO2	3		2		1	2		2			1		2	1
CO3	3		2		1	2		2			1		2	1
CO4	3		2		1	2		2			1		2	1
Average* (Rounded to nearest integer)	3		2		1	2		2			1		2	1

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	Indian Electricity Rules & Regulations: Power sector organization and their roles; significance of IE rules & IE acts; general safety requirements: Span, conductor configuration, spacing and clearing, sag, erection, hazards of electricity	**CO1,**
II	**Electrical Safety in Residential, Commercial and Agricultural Installations:** Wiring and fitting –Domestic appliances –water tap giving shock –shock from wet wall –fan firing shock –multi-storied building – Temporary installations –Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.	**CO1**
III	**Electrical Safety during Installation, Testing and Commissioning, Operation and Maintenance:** Preliminary preparations –safe sequence –risk of plant and equipment –safety documentation –field quality and safety personal protective equipment –safety clearance notice –safety precautions – safeguards for operators –safety.	**CO2**

IV	**Electrical Safety in Hazardous Areas:** Hazardous zones –class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours –classification of equipment/enclosure for hazardous locations	**CO1, CO3,**
V	**Fire Extinguishers**: Fundamentals of fire - initiation of fires, types; extinguishing techniques, prevention of fire, types of fire extinguishers, fire detection and alarm system; CO2 and Halogen gas schemes; foam schemes.	**CO1, CO4**

Learning Resources
Text books
1. Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1988.
References
1. Cooper. W.F, "Electrical Safety Engineering", Newness-Butterworth Company, 1978. 2. John Codick, "Electrical safety hand book", McGraw Hill Inc., New Delhi, 2000. 3. Nagrath, I.J. and Kothari, D.P., "Power System Engineering", Tata McGraw Hill, 1998. 4. Wadhwa, C.L., "Electric Power Systems", New Age International, 2004.

PVP 19

FUNDAMENTALS OF CYBER LAW

Course Code	19ES5501C	**Year**	III	**Semester**	I
Course Category	Open Elective I	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		**Blooms Taxonomy Level**
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of Section 80 of IT Act 2000, Cyber Crime, Computer Crime, Internet Theft/Fraud, Goods and Services.	**L2**
CO2	Demonstrate the basic concepts of Cognizable and Non-Cognizable Offences, Hacking, Teenage Web Vandals, Prevalence and Victimology, Consumer Protection Act.	**L3**
CO3	Analyze the concepts of Arrest for "About to Commit" an Offence Under the IT Act, A tribute to Draco, Cyber Fraud, Computer as Commodities, Consumer Complaint.	**L4**
CO4	Explain the concepts of Arrest, But No Punishment, Cyber Cheating, Theft of Intellectual Property, Restrictive and Unfair Trade practices	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	3					2	2
CO2						2	2	3					2	2
CO3						2	2	3					2	2
CO4						2	2	3					2	2
Average* (Rounded to nearest integer)						2	2	3					2	2

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**The IT Act, 2000:A Critique:** Crimes in Millennium, Section 80 of the IT Act, 2000-AWeapon or a Farce?, Forgetting the Line between Cognizable and Non-Cognizable Offences, Arrest for "About to Commit" an Offence Under the IT Act, A tribute to Draco, Arrest, But No Punishment	**CO1, CO2, CO3, CO4**
II	**Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000:** Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cyber Cheating.	**CO1, CO2, CO3, CO4**
III	**Traditional Computer Crime: Early Hacker and Theft of Components:** Traditional Problems, Recognizing and Defining Computer Crime, Phreakers: Yesterday's Hackers, Hacking, Computer as Commodities, Theft of Intellectual Property.	**CO1, CO2, CO3, CO4**

IV	**Identity Theft and Identity Fraud:** Typologies of Internet Theft/Fraud, Prevalence and Victimology, Physical Methods of Identity Theft.	**CO1, CO2, CO3, CO4**
V	**Protection of Cyber consumers in India:** Are Cyber consumers Covered under the Consumer Protection Act?, Goods and Services, Consumer Complaint, Restrictive and Unfair Trade practices	**CO1, CO2, CO3, CO4**

Learning Resources
Text books
1. Vivek Sood, "Cyber Law Simplified", Tata McGraw Hill. 2. Marjie T. Britz, "Computer Forensics and Cyber Crime", Person. 3. Ferrera, "Cyber Laws Texts and Cases", Cengage.
References
1. Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, 2nd Edition, PHI, 2003. 2. Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, 1st Edition, New Delhi, 2003. 3. Sharma, S.R., "Dimensions Of Cyber Crime", Annual Publications Pvt. Ltd., 1st Edition, 2004. 4. Augastine, Paul T.," Cyber Crimes And Legal Issues", Crecent Publishing Corporation, 2007
e-Resources and other Digital Material
1. https://www.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamental-issues-xndSq 2. https://www.youtube.com/watch?v=F7mH5vz1qEI&list=PLf8YqCm9HoI6fb4LdoY2tFgJfM0PrgInS&ab_channel=ComputingforAll 3. https://www.youtube.com/watch?v=F7mH5vz1qEI&t=41s&ab_channel=ComputingforAll

PVP 19

ENVIRONMNET & ECOLOGY

Course Code	19ES5501D	**Year**	III	**Semester**	I
Course Category	Open Elective I	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	Understand and integrate information related to structure and functions of ecological units. (L2)
CO2	Apply and communicate the concepts of environment.(L3)
CO3	Analyze various environmental components and demonstrate using technology. (L4)
CO4	Analyze and evaluate policies and frame works for welfare of environment & social sustainability. (L4)
CO5	Apply system concepts for bio-monitoring environmental issues.(L3)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2							
CO2	3						2							
CO3	3						2							
CO4	3						2							
CO5	3						2							
Average* (Rounded to nearest integer)	3						2							

SYLLABUS		
UNIT NO	Contents	Mapped COs
I	**Ecology:** Introduction – Biosphere, scope, organisation and significance. Ecosystem concept- structure & function, Factors affecting ecosystem. Evolution: Natural Selection and its ecological significance. Population parameters- growth regulation, relationships between organisms.	CO1 CO2
II	**Natural Resources & Management:** Resource- Definition, category, concept and scarcity of resource. Forests & wild life- Global productivity & human activities (Exploitation). Land resource- use pattern in India, soil & soil Conservation. Water resource- potentials and use with special reference to India, Concept of Integrated Water Resources Management (IWRM). Remote Sensing and GIS: Applications in conserving resources.	CO1 CO2

III	**Environmental Geosciences & Computer Applications** Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Scale of meteorology, pressure, temperature, atmospheric stability. Graphical representation of Data, creating Database tables.	CO1 CO3
IV	**Environmental Policy, Education and Ethics** Important national policies: National environmental policy, 2006 & National agricultural policy etc. Legislation: Environment protection Act, 1986. Environmental education: Goals and objectives of environmental education. Environment awareness and action: Role of NGOs in environmental awareness. Environmental movements in India- silent valley movement, Chipko movement, Narmada bachao andolan, Environmental movements in the West- Greenpeace.	CO1 CO4
V	**Environmental monitoring and management** Environmental impact analysis and EMP; Analytical approaches and instrumentation in environmental monitoring; Bio monitoring of air pollution - plants as biomonitors; Bio monitoring of running water pollution.(Software's) Organic farming and its ecological significance.	CO1 CO5

Learning Recourses
Text Books
1. Singh, J.S; Singh, S.P. and Gupta S.R. (2014) Ecology, Environmental Science and Conservation. S.Chand & Company Pvt. Ltd. New Delhi. 2. Sharma, P.D. (2011) Ecology and Environment (11thedn.). Rastogi Publication, Meerut. 3. Bharucha, E. (2013) Text Book of Environmental Studies (2nd edn.). Universities Press, Hyderabad.
Reference Books
1. Nobel, B.J. and Wright, R.T. (1995) Environmental Science. Prentice Hall. 2. Keller, E.A. (2017) Introduction to Environmental Geology (5th edition). Pearson Education, India. 3. Agarwal, S.K. (1991) Pollution Ecology. Himanshu Publication, Udaipur.

PVP 19

CONTEMPORARY RELEVANCE OF INDIAN EPICS

Course Code	19HS5501A	**Year**	III	**Semester**	I
Course Category	OPEN ELECTIVE-I	**Branch**	Common to All Branches	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to -	
CO1	Gain preliminary understanding of various Indian epics (L2)
CO2	Develop a deep insight into the famous epics and cultivate national consciousness (L3)
CO3	Apply the knowledge gained to various real life situations (L3)
CO4	Analyze the contemporary relevance of Indian epics(L4)
CO5	Interpret and correlate the ideals to one's own life. (L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2								3	2			2		
CO3								3	2			2		
CO4								3	2			2		
CO5								3	2			2		
Average* (Rounded to nearest integer)								3	2			2		

SYLLABUS		
Unit No	**Contents**	**Mapped CO**
I	Definition of the term epic Features of epic, Introduction to Indian epics, Characteristics of classical Indian epics, Importance of Indian epics.	CO1,CO4
II	Salient features of Ramayana, Epic qualities of Ramayana, Ideals to be imbibed from the first Indian epic, Moral essence in Ramayana, Impact of Ramayana on Indian society.	CO1,CO2, CO5
III	Mahabharata, Epic qualities of Mahabharata, Set of values to be acquired from the largest epic, Impact of Mahabharata on our culture and society.	CO1, CO5
IV	Relevance Of Indian Epics to the contemporary of Indian society, Relevance Of Indian Epics to the contemporary world.	CO1,CO3
V	Essence of Bhagavad Gita, justification of the triumph of virtue over vice, Importance of truth and Self-sacrifice.	CO1,CO2, CO5

Learning Resources
1. Geethadarshan by Rama krisha mission 2. The palace of illusion- Chitra Banerjee Divakaruni, 3. My Gita- Devdutt Pattankaik, Asura: tale of Vanquished- Anand Neelakantan 4. Prince of Ayodhya: Book one-Ashok K.Banker, 5. The Hindus: An Alternative History- Wendy Doniger, Myth and Reality: Studies in the Formation of Indian Culture-D.D. Kosambi, Mahabharath- William Buck

PVP 19

INDIAN NATIONAL MOVEMENT

Course Code	19HS5501B	**Year**	III	**Semester**	I
Course Category	OPEN ELECTIVE-I	**Branch**	Common to All Branches	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Understand** political, social and economic background of freedom struggle (L2)
CO2	**Specify** major stages of freedom struggle and their ideological distinctions (L5)
CO3	**Analyze** the role of nationalist movement in the making of modern India(L4)
CO4	**Develop** an attitude of nationalism cutting across limited boundaries of religion in order to resist communal forces(L5)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						1			1					
CO2						2			2					
CO3						2			2					
CO4						2			2					
Average* (Rounded to nearest integer)						2			2					

Syllabus

Unit No.	Contents	Mapped CO
I	Module -I Back ground : Early British Colonialism in India, early rebellions – Pazhassi raja (the cotiote war -Kerala, 18 th century), Veerapandiyan Kattabomman (Taminadu/Madras Presedency-18th century), Paik rebellion (Kalinga/ Odisha, early 19th century), Vellore mutiny (early 19th century); The Sepoy Mutiny of 1857 and its consequences.	CO1
II	Module -II Contributory Factors: Socio political consciousness, growth of Western education and its impact socio -religious movement, British Economic Policies and their impact.	CO1
III	Module -III Rise of Organized Movements: Emergence of Indian National Congress, its policies and programmes, partition of Bengal, rise of radical nationalists, Bal-Lal-Pal, formation of Muslim league; Minto-Morely reforms, the national movement during the first world war.	CO2

IV	Module -IV Gathering Momentum: Non-cooperation and civil disobedience, emergence of Gandhi, some prominent revolutionaries - Khudiram Bose, Prafulla Chaki, Bhupendra Nath Dutt,V.D. Savarkar, Sardar Ajit singh, Lala Hardayal, Sardar Bhagat Singh, Raj Garu, Sukh Deo, Chandra Shekhar Azad, development of socialist ideas, communal divide.	CO3
V	Module -V Towards Independence: Constitutional developments, provincial elections, quit India movement and after, participation of women national movement during the second world war, Indian national army, naval mutiny of 1946, freedom and partition, impact on the world.	CO4

Learning Resources

Text Books

1. K. Majumdar, Advent of Independence, Bhartiya Vidya Bhavan, Bombay 1969.
2. R. Desai, Social Background of Indian Nationalism, 5th ed., Popular Prakashan, Mumbai, 1976.
3. Bandyopadhyay, Sekhar, Nationalist Movement in India. A reader, Oxford university press, 2008.
4. Chandra, Bipin, National and colonialism in modern India, Orient Longman Limited New Delhi, 1979.

PVP 19

ENGINEERING FOR COMMUNITY SERVICE

Course Code	19HS5501C	Year	III	Semester	I
Course Category	OPEN ELECTIVE-1	Branch	Common to all	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	NIL
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the intricacies of engineering profession. (L2)
CO2	Examine the role that engineering might play in the different aspects of sustainability development. (L3)
CO3	Solve basic analytical and design problems using engineering tools, and be proficient and efficient in the use of these tools. (L3)
CO4	Explore various awareness methods about safety, risk & risk benefit analysis (L4)
CO5	Analyze what constitutes social justice in different areas of social life and the role that engineering might play in these. (L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3	3				2	2	
CO2						3	3	3				2	2	
CO3						3	3	3				2	2	
CO4						3	3	3				2	2	
CO5						3	3	3				2	2	
Average* (Rounded to nearest integer)						3	3	3				2	2	

SYLLABUS		
UNIT NO.	CONTENT	Mapped CO
I	**The Engineering Profession** 1.1 On being a Professional 1.2 Technical Expertise and Ethical Obligations 1.3 Organization of Professional Engineering 1.4 Engineering Codes of Ethics	CO1, CO2, CO5
II	**Engineering and Sustainable Community Development** 2.1 Understanding Community 2.2 Engineers' Beliefs about Community Development 2.3 Measuring Sustainability 2.4 Engineers as Problem Solvers	CO1, CO2, CO4

III	**Engineers and Development** 3.1 Engineering Disasters: Lessons to be Learned 3.2 Technology for Community Development 3.3 Renewable Sources of Energy 3.4 Green and Smart Cities	CO1, CO3, CO4
IV	**Safety of the Public** 4.1 Ethical Dilemmas 4.2 Calculating the Value of Life 4.3 Whistle blowing 4.4 Trusting the Experts 4.5 Case Studies: a. Sinking of the Titanic b. Bhopal Gas Tragedy	CO1, CO3, CO4
V	**Engineering and Social Justice** 1.1 Social Justice in Engineering Sciences 1.2 Humanities and Social Sciences in Engineering Education 1.3 Transforming Engineering Education and Practice 1.4 Making Social Justice Visible and Valued	CO1, CO3, CO5

LEARNING RESOURCES

Reference Books:

1. Deborah G. Johnson. (2020) *Engineering Ethics: Contemporary and Enduring Debates*. Yale University Press.
2. Vesilind, P. Aarne., Gunn, Alastair S. (2010) *Hold Paramount: The Engineer's Responsibility to Society*. Cengage Learning.
3. Luegenbiehl, Heinz., Clancy, Rockwell. (2017) *Global Engineering Ethics*. Butterworth-Heinemann, UK.
4. Traer, Robert. (2018) *Doing Environmental Ethics*. New York: Routledge.
5. Leydens, Jon., Lucena, Juan. (2017) *Engineering Justice: Transforming Engineering Education and Practice.* Wiley: IEEE Press.

PVP 19

PERSONALITY DEVELOPMENT

Course Code	19HS5501D	**Year**	III	**Semester**	I
Course Category	Open Elective I	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the fundamentals of various aspects of personality traits (L2)
CO2	Apply various aspects of soft skills and personality development(L3)
CO3	Analyse the various techniques of stress management(L4)
CO4	Acquire the significant factors of affecting attitudes(L4)
CO5	Develop Interpersonal communication.(L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2									3	3		3		
CO3									3	3		3		
CO4									3	3		3		
CO5									3	3		3		
Average* (Rounded to nearest integer)									3	3		3		

SYLLABUS

UNIT NO.	CONTENT	Mapped CO
I	Personality: Grooming one's personality, Personality traits, Influence of heredity and environment on personality, Effective habits, Emotional intelligence.	CO1,CO2
II	Conflict resolution, Assertive nature, Decision making skills.	CO1,CO2, CO4
III	Techniques of time management, Teamwork, Self-confidence, Stress management	CO1,CO3, CO5
IV	Attitude-concept, Positive attitude-advantages, Negative attitude - disadvantages	C01,CO2, CO4
V	Qualities of successful leader, Interpersonal relationship, Good manners & etiquette.	CO1 ,CO5

LEARNING RESOURCES

Text Book

1. Personality development &soft skills Barun K.Mith Oxford.

Reference Books

1. Personal & emotional competence, V.Bhaskara Rao, B.S.P
2. Step by Step –Niruparani. K, Jayasree Mohanra, Pearson.

e- Resources & other digital material

1. https://www.usingenglish.com/comprehension/;
2. https://www.englishclub.com/reading/short-stories.htm;
3. https://www.english-online.at/All Skills:
4. https://www.englishclub.com/;
5. http://www.world-english.or

PVP 19

INTRODUCTION TO INTERNATIONAL BUSINESS

Course Code	19HS5501E	**Year**	III	**Semester**	I
Course Category	Open Elective I	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	-
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes

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

CO1	Apply the concepts of global dynamics which affect businesses and multinational firms in leveraging their capabilities and competencies.
CO2	Compare and contrast cultures and societies globally using socioeconomic, cultural and ethical frameworks
CO3	Relate business expansion concepts abroad to key issues related to their operations in other countries.
CO4	Develop entry strategies into other markets by recognizing the nature of institutions and forces governing the process of globalization.
CO5	Use the concepts in international business with respect to foreign trade.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1			3	2							3	3		
CO2			3	2							3	3		
CO3			3	2							3	3		
CO4			3	2							3	3		
CO5			3	2							3	3		
Average* (Rounded to nearest integer)			3	2							3	3		

SYLLABUS

UNIT NO.	**CONTENT**	Mapped CO
I	INTRODUCTION: History and Features of International Business. Globalization – Forces and dangers Firms' face during International Business. International Business Environment - Geographical, Economic, Socio-cultural, political and legal environment, Culture and International Business	CO1
II	Conceptual framework of Multinational Enterprise (MNE) International Trade and Foreign Direct Investment, Understanding Emerging Markets and Regional Economic Integration, Fundamentals of International Monetary System	CO2
III	International economic institutions and agreements WTO, UNCAD, IMF, World Bank; Generalized system of preferences- GSTP International commodity agreements	CO3
IV	Modes of Operations in International Business, Exporting, Importing, and Global Sourcing, Differences between Domestic and International Business, E-Business	CO4

V	Social Responsibility and Ethics in International Business Counter trade IT and International Business Foreign Trade Policy/Trade Policy framework in India Export Promotion: Export Facilities & Incentives and Status holders and Export Zones.	CO5

LEARNING RESOURCES
Text Book
1. Aswathappa," International Business", Tata Mc Graw Hill publications, New Delhi 2. Black and Sundaram, "International Business Environment", Prentice Hall of India, New Delhi. 3. Cherunilam Francis, "International Business", PHI Learning Pvt. Ltd., 2020
Reference Books
1. Adhikary, Manab, "Global Business Management", Macmillan, New Delhi. 2. Sumati Varma, "International Business", Pearson

PVP 19

GANDHIAN PHILOSOPHY

Course Code	19HS5501F	**Year**	III	**Semester**	I
Course Category	OPEN ELECTIVE-I	**Branch**	Common to All Branches	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to -	
CO1	Infer Gandhi principles of life and peaceful methods for conflict resolution
CO2	Make use of Gandhi learned lessons in his early life, advantages of self-introspection and practice of the truth
CO3	Function as transformed individual to respect all faiths and follow non-discrimination with simple living
CO4	Take Part in Swatch Baharat and Atmanirbhar Bharat Abhiyaan

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3	3	3					
CO2						3	3	3	3					
CO3						3	3	3	3					
CO4						3	3		2			3		
Average* (Rounded to nearest integer)						3	3	3	3			3		

SYLLABUS

Unit No.	Contents	Mapped CO
I	Gandhi –The Man and His Times: Early life and education, lessons learnt from his wife, in South Africa, influence of Thoreau, Tolstoy and other thinkers, return to India, Sabarmati ashram, role in the Indian national movement, his impact during his life time	CO1,CO2
II	Interpretation and Pursuit of Truth: Learning through trial and error; power of introspection, truth in thought, speech and action, pursuit of truth as true devotion to god, truth leads to courage and victory.	CO2
III	Peace and Conflict Resolution: Ahimsa as practical idealism – the means to the goal of truth, non-violent civil resistance, living faith in the power of nonviolence, prerequisites for practice, faith, courage and humility, prevention of structural violence, two pronged approach – conflict resolution and establishing peace, examples of methods and practices.	CO2

IV	Transformation of the Individual: Liberating the mind from dogmatism, control of the senses, thoughts and actions, respect for all faiths and universalism, a few strategies- Anasakta Karma, non-discrimination, simple living and self-sufficiency.	CO3
V	Contemporary Relevance: Gandhi's social, political and economic thought, sarva dharma sambhava – tolerance, respect towards all religions, educational reform – basic education and adult education, social equality sarvodaya, removal of untouchability, communal unity, women empowerment, prohibition, service of backward classes, village sanitation, political solutions- swaraj, decentralization of power, democracy of enlightened majority, economic solutions – swadeshi, trusteeship, khadi and village industries, decentralization of wealth, sustainable development and equal opportunity, youth as agents of change.	CO4

Learning Resources

References

1. Gandhi M.K., Mahadev H. Desai, Gandhi An Autobiography: The Story of My Experiments With Truth, Beacon Press, 1993.
2. Fisher, Louis, the Essential Gandhi: An Anthology of His Writings on His Life, Work, and Ideas. Vintage Books, 1983.
3. http://www.mkgandhi.org/main.htm Comprehensive Website by Gandhian Institutions – Bombay Sarvodaya Mandal and Gandhi Research Foundation

PVP 19

INDIAN HISTORY

Course Code	19HS5501G	**Year**	III	**Semester**	I
Course Category	OPEN ELECTIVE-I	**Branch**	Common to All Branches	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	**Understand** the socio-economic-cultural conditions of ancient India
CO2	**Know** the contribution of various dynasties to Indian Culture
CO3	**Examine** the invasion of different foreign rulers and their effect on Indian culture
CO4	**Analyse** the impact of British colonial rule on industrialisation and introduction of western education in India
CO5	**Describe** the national movements against British rule.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2						2		1
CO2						2						2		1
CO3						2						2		1
CO4						2						2		1
CO5						1						1		1
Average* (Rounded to nearest integer)						2						2		1

SYLLABUS

Unit No.	Contents	Mapped CO
I	**Ancient Indian History and Culture** –Indus Valley Civilization: Salient Features, Vedic and Later Vedic Culture, Doctrines of Jainism and Buddhism, Mauryans – Administration, Ashoka's Dhamma, Satavahanas, Guptas –Socio-Economic-Cultural Conditions.	CO1
II	**Medieval Indian History and Culture** – Delhi Sultanate, Great Mughals South Supremacy and Conflicts Pallavas, Cholas, Kakatiyas, Vijayanagara Empires their Contribution to Indian Culture.	CO2
III	**Modern Indian History and Culture** – European penetration In to India, Anglo-French Rivalry for Supremacy, The battle of Plassey establishment of British Power ,Consolidation and expansion tools, Subsidiary Alliance, Doctrine of Lapse .	CO3

IV	**Impact of British Colonial Rule** –Commercialization of Agriculture, de industrialization- decline of cottage Industries, famines and condition of Peasants, Introduction of Western Education in India, the great Revolt of 1857.	CO4
V	**The Rise of Indian National Movement** – Socio- Religious Movements the Genesis of Freedom Movement –Birth of Indian National Congress, -Freedom Struggle (1885-1920) Moderate Phase Partition of Bengal-Emergence of Militant Nationalism-Swadeshi & Boycott Movement –Home Rule Movement Freedom Struggle (1920-1947) Gandhi's role in Indian National Movement .	CO5

Learning Resources
Text Books
1. Krishna Reddy, Indian History, McGraw Hill Education; second edition, 2017
References
1. Sailendranath sen, a text book of Indian history and culture, Primus, 2019. 2. VK Agnihotri, Indian History And Culture , Allied publisher private limited; 28th edition, 2013
e- Resources & other digital material
1. https://onlinecourses.swayam2.ac.in/cec20_hs04/preview

PVP 19

INTERNET OF THINGS LAB

Course Code	19ES1552	**Year**	III	**Semester**	I
Course Category	ES	**Branch**	All branches	**Course Type**	Lab
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Nil
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Develop** various sensor interfacing using Visual Programming Language (L6)
CO2	**Analyze** various Physical Computing Techniques (L4)
CO3	**Evaluate** Wireless Control of Remote Devices (L5)
CO4	**Design and develop** Mobile Application which can interact with Sensors and Actuators (L6)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3		3	2	2		3	3		3	3	3
CO2	2	3				2	2		3	3		2	3	3
CO3	3	3				2	2		3	3		2	3	3
CO4	3	3	3	3	3	2	2		3	3		3	3	3
Average* (Rounded to nearest integer)	3	3	3	3	3	2	2		3	3		3	3	3

Syllabus

Expt. No.	Contents	Mapped CO
I	Digital I/O Interface - Multicolour Led, IR Sensor, PIR, SlotSensor.	CO1
II	Analog Read and Write - Potentiometer, Temperature Sensor, Led Brightness Control.	CO1
III	Dc Motor Control - Dc Motor Speed and Direction Control.	CO2
IV	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.	CO2
V	Fabrication and direction control of wheeled robot using Arduino.	CO2
VI	Serial Communication - Device Control.	CO2
VII	Wireless Module Interface - Bluetooth and Wi-Fi.	CO3
VIII	Wireless Control of wheeled Robot using Bluetooth/Wi-Fi.	CO3
IX	Basic Android App Development using MIT App Inventor.	CO4
X	Smart Home Android App Development using App Inventor and Arduino.	CO4

Learning Resources

Text Books

1. Sylvia Libow Martinez, Gary S Stager, "Invent To Learn: Making, Tinkering, and Engineering in the Classroom", Constructing Modern Knowledge Press, 2016.

Reference Books

1. Michael Margolis, "Arduino Cookbook", Oreilly, 2011.

PVP 19

ANTENNA ANALYSIS AND SYNTHESIS LAB

Course Code	19EC3551	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	EMW, AA&S
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret the antenna software simulation tools L2
CO2	Design and Simulate antennas used in wireless communications for different frequency ranges and obtain their radiation characteristics L6
CO3	Experiment with a pyramidal Horn antenna and measure its radiation characteristics L3
CO4	Model a rectangular waveguide and obtain its radiation characteristics. L3

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	3								3	3
CO2	3	3	3	3	3								3	3
CO3	2	2	2	3	3								3	3
CO4	2	3	3	3	3								3	3
Average* (Rounded to nearest integer)	2	3	3	3	3								3	3

Syllabus		
S.No.	**Name of the Experiment**	**Mapped CO**
1	Introduction to Simulation software tools	CO1
2	Design a half wave dipole for a frequency of 600MHz and determine its radiation pattern, reflection coefficient, VSWR	CO2
3	Design a biconical antenna for a frequency of 600MHz and determine its radiation pattern, reflection coefficient, VSWR	CO2
4	Design Yagi - Uda antenna and simulate to get its radiation characteristics	CO2
5	Measurement of radiation pattern of a pyramidal Horn antenna	CO3
6	Design a rectangular microstrip antenna and obtain its radiation characteristics using simulation	CO2
7	Design a Circular microstrip antenna and obtain its radiation characteristics using simulation	CO2
8	Design a square loop antenna for a frequency of 6GHz and obtain its radiation pattern, reflection coefficient, VSWR	CO2

9	Model a rectangular Waveguide and obtain its radiation characteristics	CO4
10	Construct a 3-element linear array & obtain its radiation pattern using simulation	CO1, CO2

Learning Resources
Text Books
1. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
Reference Books
1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005. 2. Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007
e- Resources & other digital material
1. http://anlage.umd.edu/HFSSv10UserGuide.pdf **2.** https://www.youtube.com/watch?v=kUDlCVOPlvY

PVP 19

DIGITAL SIGNAL PROCESSING LAB

Course Code	19EC3552	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Signals and Systems
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Examine the frequency response and impulse response of discrete-time LTI systems (L3).
CO2	Interpret discrete-time signals using DFT (L3).
CO3	Apply FFT algorithms for various signal processing operations (L3).
CO4	Analyse IIR and FIR digital filters (L4).
CO5	Design IIR and FIR digital filters for real time DSP applications (L5).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3			1	1	1		2	2	2
CO2	3	3	3	3	3			1	1	1		2	2	2
CO3	3	3	2	3	3			1	1	1		2	2	2
CO4	3	3	3	3	3			1	1	1		2	2	2
CO5	3	3	2	3	3			1	1	1		2	2	2
Average* (Rounded to nearest integer)	3	3	2	3	3			1	1	1		2	2	2

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
	Part A – Using MATLAB	
I	Frequency response of a system described by a difference equation.	CO1, CO4
II	Implementation of discrete time systems in time domain.	CO1, CO4
III	DFT & IDFT of the given sequences.	CO2
IV	Properties of DFT	CO2
V	Fast Fourier Transform	CO3
VI	Design of IIR Low Pass filter using Butterworth and Chebyshev approximations.	CO4, CO5
VII	Design of IIR High Pass filter using Butterworth and Chebyshev approximations.	CO4, CO5
VIII	Design of FIR Low Pass filters using window technique.	CO4, CO5
IX	Design of FIR High Pass filter using window technique.	CO4, CO5
	Part B – Using Code Composer Studio	
X	Linear convolution of two sequences.	CO1, CO4

XI	Circular convolution of two sequences.	CO2
XII	Generation of Sine wave & Square wave.	CO4

Learning Resources
Text Books
1. G.Proakisand D.G.Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4/e, Pearson Education, 2007. 2. A.V.Oppenheim, R.W.Schafer, Discrete Time Signal Processing, 3/e, Prentice Hall of India, 2009.
Reference Books
1. Fundamentals of Digital Signal Processing - Lonnie C Ludeman, John Wiley & Sons, 2003 2. Digital Signal Processing "A – Computer Based Approach" - Sanjit K Mitra, Tata Mc Graw Hill 2nd Edition, 2003 3. Theory and Application of Digital Signal Processing - Lawrence R Rabiner& Bernard Gold, Prentice Hall.
e- Resources & other digital material
1. http://www.nptel.iitm.ac.in/ 2. http://www.ee.umanitoba.ca/~moussavi/dsp815/LectureNotes/index.html 3. http://www.ece.cmu.edu/~ee791 4. http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/notes.html

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PVP 19

ENGINEERING ECONOMICS AND MANAGEMENT

Course Code	19HS1601	Year	III	Semester	II
Course Category	HS	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	--
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	To understanding of the fundamental concepts of Managerial economics and demand.
CO2	The ability to apply knowledge to evaluate future demand and theory of production.
CO3	To understanding of the foundational concepts of cost, market structure and role of pricing methods in business.
CO4	To understanding about the principles of management and human resource management function in an organization.
CO5	To understand the broad scope of marketing, societal, ethical and other diverse aspects of marketing and production.

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2								3	3	
CO2	3	3		2								3	3	
CO3	3	3		2								3	3	
CO4	3	3		2								3	3	
CO5	3	3		2								3	3	
Average* (Rounded to nearest integer)	3	3		2								3	2	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Managerial Economics & Demand Analysis:** Definition of Managerial Economics, Nature and Scope – Managerial Economics and its relation with other subjects. Demand Analysis: Meaning - Demand determinants- Law of Demand and its exceptions.	CO1
II	**Elasticity of Demand, Demand Forecasting & Theory of Production**: Definition -Types of Elasticity of demand - Measurement of price elasticity of demand. Demand Forecasting: Meaning - Factors governing demand forecasting - Methods of demand forecasting. Production: Production Function- Law of variable proportions- Isoquants, Law of returns to scale.	CO2

III	**Cost Analysis, Market Structures & Pricing:** Cost concepts - Break-Even Point - Managerial Significance and limitations of BEP - (simple problems). Market: meaning characteristics of market and Types of market competition – Pricing strategies	CO3
IV	**Introduction to Management & Human Resource Management: Meaning,** nature, importance and Functions of Management, Henri Fayol principles. HRM: objective and function, manpower planning, sources of recruitment.	CO4
V	**Introduction to Marketing Management & Production management:** Meaning, Concepts of Marketing, Marketing Mix, Marketing Segmentation. Production management: objectives, Types of Plant Layout , location – Factors effecting it	CO5

Learning Resources

Reference Books

1. Managerial Economics and Financial Analysis, J.V.Prabhakar Rao, Maruthi Publications, 2011
2. Managerial Economics and Financial Analysis, N. Appa Rao. & P. Vijaya Kumar, Cengage Publications, New Delhi, 2011.
3. Managerial Economics and Financial Analysis, A R Aryasri, TMH, 2011.
4. Management Science, Aryasri, TMH, 2004.
5. Management Science, Rajesh C. Jampala, P. Adi Lakshmi, Duvuri Publications, Machilipatnam, 2010.

PVP 19

MICROPROCESSORS AND MICROCONTROLLERS

Course Code	19EC3601	Year	III	Semester	II
Course Category	Program Core	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Computer Architecture and Organization
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		BT Level
Upon successful completion of the course, the student will be able to		
CO1	**Compare** programmer's model of 8086 microprocessor and ARM processor.	L2
CO2	**Apply knowledge and demonstrate** programming proficiency using the various addressing modes and instructions of the target microprocessor and microcontroller.	L3
CO3	**Develop** programs to interface various peripherals with microcontroller.	L3
CO4	**Design** and develop real time application modules using ARM microcontroller	L6

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2									2	2
CO2	3	3	2	2									2	2
CO3	3	3	2	2									2	2
CO4	3	3	2	2									2	2
CO5	3	3	2	2									2	2
Average* (Rounded to nearest integer)	3	3	2	2									2	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**8086 Architecture:** Main features, 8086 microprocessor internal architecture, bus interfacing unit, execution unit, pin diagram/description, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.	CO1
II	**8086 Programming:** Program development steps, instructions, addressing modes, assembler directives, writing programs with an assembler, assembly language program development tools.	CO2

III	**Cortex-M:** **Architecture:** Introduction to Cortex-M Microcontroller, Microprocessor Architecture, Nested Interrupt Vector Controller, Bus system and Bus matrix, Memory and Peripherals, Debug System. **Exceptions and Interrupts Architecture:** The Cortex-M Exception and Interrupts, Exceptions and Interrupt Priority, Interrupt Configuration, Handling of Exceptions or Interrupts.	CO1
IV	**Programming:** Basics of Assembly Programming, Data Processing Instructions, Memory Access Instructions, Branch and Control Instructions.	CO2
V	**Interfacing:** **Fundamentals of Input-Output Interfacing:** Basic Microcontroller GPIO Interfacing, Cortex-M-Based TM4C L23 Microcontroller Peripherals, Configuring Microcontroller Pins as GPIOs, Input-Output interfacing for LED and Switch, Seven-Segment LED Interfacing, Keypad Interfacing, Interfacing an LCD module. **Timing Interfaces:** Basics of Timing Interfaces, Clocking a Microcontroller, TM4C123 Clock and Frequency Configuration, Timer Basics, TM4C123 Timing Interfaces and Systick Timer, Timer as Input Device, Timer as Output Device, General Purpose Timer modules in TMC123.	CO3, CO4

Learning Resources
Text Books
1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition. 2. ARM Microprocessor Systems – Cortex – M Architecture, Programming, and Interfacing by Muhammad Tahir and Kashif Javed, CRC Press. 3. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph You
Reference Books
1. Embedded Systems Fundamentals with ARM Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media 2. Cortex -M3 Technical Reference Manual

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WIRELESS COMMUNICATIONS AND NETWORKS

Course Code	19EC4601A	**Year**	III	**Semester**	II
Course Category	PE - II	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyze the characteristics and applications of various technologies in WCN. (L4).
CO2	Analyse the Overview and Principles of Bluetooth, Cellular Wireless Networks (L4).
CO3	Evaluate the Fourth Generation Systems, LTE and mobile IP (L5).
CO4	Evaluate the different Technologies, architecture of Bluetooth and Cellular Wireless Networks and its applications (L5).
CO5	Analyse the different Multiple Access Techniques in Cellular Wireless Networks (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2		3				2			2	3
CO2	3	3	2	2		3				2			2	3
CO3	3	3	2	2		3				2			2	3
CO4	3	3	2	2		3				2			2	3
CO5	3	3	2	2		3				2			2	3
Average* (Rounded to nearest integer)	3	3	2	2		3				2			2	3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Wireless LAN Technology:** IEEE 802Architecture, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE802.11 Physical Layer, Gigabit Wi-Fi, Other IEEE Standards, IEEE802.11 Wireless LAN Security	CO1 ,CO4
II	**Bluetooth and IEEE 802.15:** The Internet of Things, Bluetooth Motivation and Overview, Bluetooth Specifications, Bluetooth High Speed and Bluetooth Smart, IEEE 802.15, ZigBee 402	CO1,CO2 ,CO4
III	Cellular Wireless Networks: Principles of Cellular Networks, First-Generation Analog, Second-Generation TDMA, Second-Generation CDMA, Third-Generation Systems	CO1,CO2,CO4,CO5
IV	Fourth Generation Systems and LTE-Advanced: Purpose, Motivation, and Approach to 4G, LTE Architecture, Evolved Packet Core, LTE Resource Management, LTE Channel Structure and Protocols, LTE Radio Access Network, LTE-Advanced	CO1,CO3,CO4
V	Mobile Applications and Mobile IP: Mobile Application Platforms, Mobile App Development, Mobile Application Deployment, Mobile IP	CO1,CO3,CO4

Learning Resources
Text Books
1. Cory Beard, William Stallings, Wireless Communication Networks and Systems, Pearson Education, 2016
Reference Books
1. William Stallings, Wireless Communication and Networking, 2/e, Pearson Education, 2005. 2. Theodore S. Rappaport, Wireless Communications, Principles and Practice, 2/e, Prentice Hall of India, 2002 3. Kaveh Pahlaven, P. Krishna Murthy, Principles of Wireless Networks, 1/e, Pearson Education, 2002. 4. Kamilo Feher, Wireless Digital Communications, 1/e, Prentice Hall of India, 1999
e- Resources & other digital material
1.https://www.egr.msu.edu/~tongli/Introduction-WCN.pdf 2.https://youtu.be/Eu_mTZxPofI

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REAL-TIME SIGNAL PROCESSING

Course Code	19EC4601B	**Year**	III	**Semester**	II
Course Category	Program Elective II	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Digital Signal Processing
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Generate waveforms using DSK for real time applications (L3)
CO2	Perform various operations using TMS320C6X DSP Processor (L4).
CO3	Implement IIR systems in Direct, Cascade and Parallel forms (L3).
CO4	Develop and realize computationally efficient algorithms on the DSP platform using FFT (L5).
CO5	Design real-time FIR and IIR filters on the DSP platform (L5).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2							1	2	1
CO2	3	3	2	2	2							1	2	1
CO3	3	3	2	2	2							1	2	1
CO4	3	3	2	2	2							1	2	1
CO5	3	3	2	2	2							1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2							1	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Input and output with DSK**: Introduction, sampling, reconstruction aliasing, programming examples using C code, basic input and output using polling, basic input and output using interrupts. **Real time Sine wave generation:** sine wave generation using sin function call, sine wave generation with table created by Matlab, Signal Reconstruction, Aliasing and properties of the AIC23 codec, AM generation, ramp generation.	**CO1, CO2**
II	**Architecture and Instruction set of the C6x Processor: I**ntroduction, TMS320C6x architecture, Linear and Circular Addressing Mode, types of Instruction, Assembler Directives, timers, interrupts, Interrupt control registers, multi-channel buffer serial port, memory considerations, fixed and floating point format, constraints, programming examples using C, Assembly and Linear assembly.	**CO2**
III	**Finite Impulse Response Filters:** Introduction, Linear Phase FIR filters, FIR implementation using Fourier series method, FIR	**CO2,**

	implementation using window (rectangular, Hanning, Hamming, Blackman) technique, Moving Average Filter FIR Filter design using MATLAB.	**CO5**
IV	**Infinite Impulse Response Filters**: Introduction, IIR filter structure: Direct Form-I, Direct Form-II, Cascade and Parallel forms, Impulse invariance method, Bilinear transformation, IIR filter design using MATLAB.	**CO2, CO3, CO5**
V	**Fast Fourier Transform** : Introduction, development of radix-2 FFT algorithms, Decimation in time FFT algorithm, Decimation in frequency FFT algorithm, Inverse Fast Fourier transform using DIT and DIF algorithms. DFT of a sequence of real number without put in CCS graphics display window	**CO2, CO4**

Learning Resources
Text Books
1. Rulph Chassaing, Digital Signal Processing with C6713 and C6416DSK, 2/e Wiley Publications, 2005 2. DSP processor fundamentals, Architecture& Features-Lapsleyetal. S. Chand & Co.2000
Reference Books
1. Sanjay K.Mitra, Digital Signal Processing-A Computer Based Approach, 4/e, Tata McGraw Hill Publications, 2011. 2. Theory and Application of Digital Signal Processing - Lawrence R Rabiner & Bernard Gold, Prentice Hall.
e- Resources & other digital material
1. http://www.nptel.iitm.ac.in/ 2. http://www.ee.umanitoba.ca/~moussavi/dsp815/LectureNotes/index.html 3.http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/notes.html

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DSP DESIGN WITH FPGAs

Course Code	19EC4601C	**Year**	III	**Semester**	II
Course Category	Program Elective-II	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Digital Logic Design
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyze signal processing architectures and implement them on FPGA platforms. [L4]
CO2	Explain number formats for computers [L2]
CO3	Analysis and comparison of digital filters for processing of discrete time signals[L4]
CO4	Analyze Fourier transforms on signals and acquire knowledge about Systems[L4]

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3		3					3			3	
CO2	3		3		3					3			3	
CO3	3	3								3			3	
CO4	3	3								3			3	
Average* (Rounded to nearest integer)	3	3	3	3	3					3			3	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Overview of Digital Signal Processing, FPGA Technology, DSP Technology Requirements, Design Implementation	CO-1
II	Computer Arithmetic: Number Representation, Binary Adders, Binary Multipliers, Fixed Point, Arithmetic Implementation, Floating Point Arithmetic Implementation, CORDIC.	CO-2
III	FIR Digital Filters: Digital Filters, FIR Theory, Designing FIR Filters, Constant Coefficient FIR Design: Direct FIR Design, FIR Filter with Transposed Structure.	CO-3
IV	IIR Digital Filters: IIR Theory, IIR Coefficient Computation, IIR Filter Implementation	**CO-3**
V	Fourier Transforms: DFT algorithms: Fourier Transform Approximations using the DFT, Properties of the DFT, FFT algorithms: Cooley-Tukey FFT algorithm.	**CO-4**

Learning Resources
Text Books
1. Uwe Meyer-Baese, Digital Signal Processing with Field Programmable Gate Arrays, Fourth Edition, Springer Publications, 2014
Reference Books
1. Roger Woods, John McAllister, Dr. Ying Yi, FPGA-based Implementation of Signal Processing Systems, Wiley Publications, 2011. 2. Shoab Ahmed Khan, Digital Design of Signal Processing Systems, Wiley Publications, 2011. 3. Keshab Parhi, VLSI Digital Signal Processing, Wiley Student Edition, 2010.

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MICROWAVE ENGINEERING

Course Code	19EC4601D	**Year**	III	**Semester**	II
Course Category	Programme Elective II	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	TLWG
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret various frequency bands of microwave range and their designations in electromagnetic spectrum and applications of microwaves. [L2]
CO2	Analyze the properties of microwave tubes and microwave solid state devices [L4]
CO3	Identify different types of waveguide passive components for engineering applications. [L3]
CO4	Build Microwave Bench for measurement of various microwave parameters.[L3]

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1									1	2
CO2	3	2	2	2									1	2
CO3	3	2	2	3									1	2
CO4	3	2	2	2									1	2
Average* (Rounded to nearest integer)	3	2	2	2									1	2

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	Microwave Tubes Electromagnetic Spectrum and Microwave bands, Applications of microwaves, Limitations of conventional Tubes at Microwave Frequencies, Microwave Tubes –Classification**. O-type Tubes** : Two Cavity Klystron – Re-entrant Cavities, Velocity Modulation, Bunching Process, Expressions for O/P Power and Efficiency. **Reflex Klystrons** – Velocity Modulation, Power Output, Efficiency, Oscillating Modes and O/P Characteristics.	CO1 ,CO2
II	Helix Traveling -Wave Tubes (TWTs): Slow Wave Structures, Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations. M-Type Tubes - Introduction, Cross-field Effects, Cylindrical Traveling Wave Magnetron –Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics	CO1,CO2

III	Microwave Waveguides and Components– Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card and Rotary Vane type; Waveguide Phase Shifters – Dielectric and Rotary Vane type. Scattering Matrix Properties - Waveguide Multiport Junctions - E plane and H plane Tees, Magic Tee, S- matrix. Two–Hole Directional Couplers, S- matrix of a Directional Coupler. Ferrites– Composition and Characteristics, Faraday rotation, Ferrite Components – Gyrator, Isolator and Circulator, Smatrix.	CO1,CO3
IV	Microwave Solid State Devices Introduction, Classification, Applications. TE Devices – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Avalanche Transit-Time Devices- IMPATT and TRAPATT,PIN diode	CO1,CO2
V	Description of Microwave Bench – Different components and their Features, Errors and Precautions, Measurement of Attenuation, Frequency, Microwave Power using Bolometer Bridge, Calorimetric method, Measurement of VSWR, Cavity Q, Impedance Measurement.	CO1,CO4

Learning Resources
Text Books
1. Foundations for Microwave Engineering – R.E. Collin, John Wiley, 2nd Edition, 2005 2. Samuel Y Liao, "Microwave Devices and Circuits", 3rd edition, 2003, Pearson Education.
Reference Books
1. Annapurna Das, Sisir K Das, "Microwave Engineering", 2nd edition, 2006, Tata McGraw Hil 2. Microwave Engineering- David M.Pozar, John Wiley & Sonsm, Inc., 2nd Edition, 2004 3. Microwave Circuits and Passive Devices – M.L. Sisodia and G.S.Raghuvanshi, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995. 4. Microwave Engineering Passive Circuits – Peter A. Rizzi, PHI, 1999
e- Resources & other digital material
1 https://nptel.ac.in/courses/108/103/108103141/ 2. http://www.intechopen.com/---/passive_microwave_components_ana_antenna 3. 3.http://www.slideshare.net/sarahkrystelle/lecture-notes-microwaves

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ARM SYSTEM DEVELOPMENT

Course Code	19EC4601E	**Year**	III	**Semester**	II
Course Category	Program Elective II	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Illustrate the features of embedded systems, architecture of ARM7 and applications (L4).
CO2	Classify between ARM and THUMB instruction set and achieving competency in assembly programming of ARM. (L2).
CO3	Articulate the exception, interrupts and interrupt handling schemes (L3).
CO4	Interpret the architectural features of LPC2148 microcontrollers (L2).
CO5	Demonstrate the hardware and interfacing peripheral devices to LPC2148 (L3)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
*** - Average value indicates course correlation strength with mapped PO**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	2					2						2	3	2
CO2	3	3	2		2	2						2	3	2
CO3	3	2	2			2						2	3	2
CO4	2					2						2	3	2
CO5	2	3	3	2	2	2	2	2				2	3	3
Average* (Rounded to nearest integer)	3	2	2	1	1	2	1	1				2	3	3

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	Introduction to ARM 7 Architecture: The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM core data flow model, Registers, CPSR-Processor modes.	CO1
II	ARM Instructions set: Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status Register instruction, Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb.	CO2
III	Exception handling: ARM processor exceptions and modes, vector table, exception priorities, link register offsets. Interrupts- assigning interrupts, interrupt latency, IRQ and FIQ exceptions with example- code for enabling and disabling IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design	CO3

IV	Introduction to ARM7 microcontroller: LPC2148 ARM 7 microcontroller, Features of LPC2148, Architecture of LPC2148, Addressing mode, Memory organization, ARM register model, programmer model, oscillator, PLL, CPSR, SPSR,3stage pipelining.	CO4
V	Interfacing with ARM: LED, GPIO programming with embedded C, LCD interfacing, programming of LCD, ADC, Interfacing of LM35 temperature sensor, DAC, Timers, UART programming, transfer of a character and receive of a character program.	CO5

Learning Resources
Text Books
1.Andrew N. SLOSS,"ARM System Developer's guide", ELSEVIER Publications, 2016 2.Steve Furber, "ARM System-on-chip Architecture", Pearson Education, 2012
Reference Books
1. In Sider 's Guide To Philips Arm7 Based Microcontroller ,Shitex.co.uk 2. ARM Assembly Language – William Hohl, CRC Press

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RFID ENABLED SENSOR DESIGN AND APPLICATIONS

Course Code	19EC4601F	Year	III	Semester	II
Course Category	PE - II	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Sensors &IoT
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Describe the functions, rules and operations of an RFID components and systems	L3
CO2	Outline the performance characteristics of different types of RFID sensors and systems	L2
CO3	Analyze the different RFID enabled sensors	L4
CO4	Develop RFID for Healthcare, Wellness and Environmental Applications	L5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2	2	1							2	2	1
CO2	3		2	2	1							2	2	1
CO3	3		2	2	1							2	2	1
CO4	3		2	2	1							2	2	1
Average* (Rounded to nearest integer)	3		2	2	1							2	2	1

Syllabus

Unit No.	Contents	Mapped CO
I	Fundamentals and Operating principles of RFID: Introduction-Barcode Systems, magnetic Strip Card, Smart cards, RFID systems- History of RFID. RFID Tag Components: Tag Antenna, Integrated Circuits, Substrate. RFID Tag Types: Passive Tags, Active Tags, The 1-Bit Transponder and Chip less Tags.	CO1, CO2
II	Communication Fundamentals in RFID Systems: Coupling Mechanisms-Data Encoding- Multipath Effect-Tag Reader and Sensor Communication-Passive Systems-Active Systems, UWB, Zigbee and Wi-Fi Tags.	CO1, CO2
III	Fundamentals and Operating principles of Sensors: Types of Sensors, Use of Sensors, Basic Considerations of Sensor Design, Requirements for Accuracy, Requirements for Resolution,	CO1, CO2

	Environment of the Sensor, Calibration, Wireless Sensors and Wireless Sensor Networks.	

IV	Design of RFID-Enabled Sensors: RFID Antenna Design Challenges, Antenna Basics and the Dipole, Passive RFID Antennas Using Serial Stubs, Bowtie T-Match RFID Antenna, Passive RFID Antenna Using Inductively Coupled Feed Structure, Voltage Multiplier for RFID Integrated Circuits, Microcontroller for Active RFID-Enabled Sensor.	CO3
V	RFID Applications: Short range RFID applications: Access Control-Transportation Ticketing-Personnel identification – Vehicle identification-Production line monitoring. Long range RFID applications: Supply chain management-Mail and shipping-Clothing Tags-Food production control	CO4

Learning Resources
Text Books
1. V. Daniel Hunt, Alber Puglia, Mike Puglia, "RFID: A guide for radio frequency identification", Wiley & Sons, Inc., Publication, 2011 2. Amin Rida, LiYang, Manos Tentzeris, "RFID-Enabled Sensor Design and Applications". 2nd Edition, ARTECH HOUSE, 2010.
Reference Books
1. Steven Shepard, "Radio Frequency Identification", 1st Edition, McGraw Hill, 2011.

PVP 19

INTRODUCTION TO VLSI DESIGN

Course Code	19EC3602	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyze and simulate Verilog modules (L4)
CO2	Program PLDs, CPLDs and FPGAs. (L4)
CO3	Analyze VLSI fabrication processes and CMOS Logic Design (L4).
CO4	Compare different scaling methods of MOS logical circuits and subsystems. (L2)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3		3					3			3	
CO2	3		3		3					3			3	
CO3	3	3								3			3	
CO4	3	3								3			3	
Average* (Rounded to nearest integer)	3	3	3	3	3					3			3	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Computer-Aided Design:** Hardware Description Languages, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments, Procedural Assignments, Modelling Flip-Flops Using Always Block, Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Verilog Data Types and Operators, Simple Synthesis Examples, Verilog Models for Multiplexers, Modeling Registers, Counters and finite state machines using Verilog Always Statements, Behavioural and Structural Verilog, Testing a Verilog Model.	CO1
II	**Programmable Logic Devices: Complex** Programmable Logic Devices (CPLDs), Field-Programmable Gate Arrays (FPGAs), Implementing Functions in FPGAs.	CO2
III	**IC Design Technology:** Integrated Circuit (IC) Era, Metal-Oxide-semiconductor (MOS) and related VLSI technology, basic MOS transistors, enhancement mode transistor action, NMOS fabrication, CMOS fabrication, comparison of NMOS, CMOS, BICMOS, GaAs technologies.	CO3

IV	**Electrical Properties of MOS circuits:** Drain current vs Drain-Source voltage relationships, MOS transistor threshold voltage, pass transistor, NMOS inverter, CMOS inverter. **MOS Circuit Design Process:** MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm micron based design rules. Layout Diagrams	CO3
V	**Scaling of MOS Circuits:** Scaling Models and Scaling factors, Scaling factors for device parameters, Limits of scaling **Subsystem Design:** Some architectural issues, Switch Logic, Gate Logic, Examples of structured design, parity generator, multiplexers	CO3,CO4

Learning Resources
Text Books
1. Charles H. Roth, Lizy Kurian John, Byeong Kil Lee, Digital Systems Design using Verilog, 1/e, Cengage Learning, 2016. 2. Douglas A, Pucknell, Kamran Eshraghian, Essentials of VLSI Circuits and Systems, 1/e, Prentice Hall, 2012
References
1. Kang, Leblibici, CMOS Digital Integrated Circuits, 3/e, Tata McGraw Hill, 2001. 2. Jan M. Rabaey, Digital Integrated Circuits, 2/e, Pearson Education, 2002. 3. Jackson, Hodges, Analysis and Design of Digital Integrated Circuits, 3/e, Tata McGraw Hill, 2010. 4. Gary S May, Simon M Sze, Fundamentals of Semiconductor Fabrication, 1/e, Wiley, 2004.
e-Resources
1. https://nptel.ac.in/courses/108/107/108107129/ 2. https://www.cin.ufpe.br/~mel/pub/prototipac%E3o/referencias/CMOS_design/CMOS-VLSI-design.pdf

PVP 19

FIBER OPTIC COMMUNICATIONS

Course Code	19EC4602A	**Year**	III	**Semester**	II
Course Category	Program Elective-III	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Engineering Physics, Analog Communications, Digital Communications
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Identify the basic components of Fiber Optic Communication system. (L3).
CO2	Illustrate different types of Optical Sources, Optical Amplifiers and Optical Detectors. (L2).
CO3	Apply the concepts of Wavelength Division Multiplexing (L3)
CO4	Analyse the modulation characteristics and effect of noise (L4).
CO5	Build fiber optic system (L3).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	3	2										2
CO2	2	3	3	2										2
CO3	2	3	3	2										2
CO4	2	3	3	2										2
CO5	2	3	3	2										2
Average* (Rounded to nearest integer)	2	3	3	2										2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Fiber Optic Communications**- Block Diagram, Advantages. **Optic Fiber Waveguides:** Ray theory, Step – Index Fiber, Graded – Index Fiber, Attenuation, Pulse Distortion and Information Rate in Optic Fibers	CO-1
II	**Light Sources and Detectors :** Light-Emitting Diodes-Surface Emitting LEDs, Edge Emitting LEDs. Laser Principles, Distributed – Feedback Laser Diode, Optical Amplifiers, Principles of Photo detection, Photomultiplier, Semiconductor Photodiode, PIN Photodiode, Avalanche Photodiode.	CO-1, CO-2

III	**Couplers and Connectors:** Principles, Fiber end Preparation, Splices, Connectors, Source Coupling, Distribution Networks, Directional Couplers, Star Couplers, Switches, Fiber Optical Isolator, Wavelength-Division Multiplexing.	CO-1, CO-3
IV	**Modulation, Noise and Detection:** Light-Emitting-Diode Modulation and Circuits, Laser-Diode Modulation and Circuits, Analog-Modulation Formats, Digital-Modulation Formats, Optic Heterodyne Receivers, Thermal and Shot Noise, Signal-to-Noise Ratio, Modal Noise, Amplifier Noise, Laser Noise	CO-4
V	**System Design and Fiber Optical Applications:** Analog System Design, Digital System Design, Applications of Fiber Optics.	CO-1, CO-5

Learning Resources
Text Books
1. Optical fiber Communication, Gerd Keiser, Mc Graw Hill. 3rd Edition , 2003 2. Joseph. C. Palais, "Fiber Optic Communications", Pearson Education, Asia, 2002.
Reference Books
1. Howes M.J., Morgan, D.V ,"Optical Fiber Communication", John Wiely.1992 2. John M.Senior, "Optical Fiber Communication: Principles and Practice", Pearson Education, 2nd edition, 2006 3. John Powers ,"Fiber Optic Systems" Irwin Publications, 1997

PVP 19

DIGITAL IMAGE PROCESSING

Course Code	19EC4602B	**Year**	III	**Semester**	II
Course Category	Program Elective-III	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Describe and explain basic operations of digital image processing. (L2)
CO2	Analyse and Design image processing algorithms (L4).
CO3	Implement image processing algorithms. (L4).
CO4	Apply the image processing algorithms in practical applications. (L3)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1		1								2	
CO2	2	2	2	2	1								2	
CO3	2	2	2	2	3								2	
CO4	2	2	2	2	2	1		1	1		1	1	2	
Average* (Rounded to nearest integer)	2	2	2	2	2	1		1	1		1	1	2	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Digital Image fundamentals:** Digital Image Representation, Fundamental steps in image processing, Concept of gray levels. Gray level to binary image conversion, Sampling and quantization, Resolution, Relationship between pixels. **Image Transforms:** 2-D discrete fourier transform and its Properties, Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hotelling transform.	CO1, CO2, CO4
II	**Image Enhancement in Spatial Domain:** Point processing, Histogram processing, Image smoothing & Image sharpening. **Image Enhancement in frequency Domain:** Steps involved in frequency domain filtering, Image smoothing & Image sharpening.	CO1, CO2, CO3, CO4
III	**Image compression:** Redundancies and their removal methods, Fedility criteria, Image compression models, lossy and lossless compression.	CO1,CO2, CO3, CO4

IV	**Image segmentation:** Detection of discontinuities, edge linking and boundary detection, thresholding, region – oriented segmentation.	CO1, CO2, CO3, CO4
V	**Colour image processing**: Colour fundamentals, Colour models, Pseudo colour image processing, full colour image processing	CO1, CO2, CO3, CO4

Learning Resources
Text Books
1. Digital Image processing – R.C. Gonzalez & R.E. Woods, Addison Wesley/ Pearson education, 3rd Edition, 2002.
Reference Books
1. Fundamentals of Digital Image processing – A.K.Jain, PHI. 1989 2. Digital Image processing- S Jayaraman, S Esakkirajan and T. Veerakumar. TMH, 3rd Edition, 2010. 3. Digital Image Processing – William K. Pratt, John Wilely, 3rd Edition, 2004. 4. The Essential Guide to Image Processing-Alan c. Bovik, Academic Press, 2009.
e- Resources & other digital material
1. 1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/ Digi_Img_Pro /ui/TOC.htm 2. http://nptel.iitm.ac.in/video.php?subjectId=117105079 3. http://en.wikipedia.org/wiki/Digital_image_processing. 4. http://www.filestube.com/d/digital+image+processing+gonzalez+solution.

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ASIC DESIGN

Course Code	19EC4602C	**Year**	III	**Semester**	II
Course Category	Program Elective-III	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Digital Logic Design
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Describe the programming technologies of an ASIC and its construction (L2).
CO2	Design and simulation of digital ICs using Verilog (L5)
CO3	Compare different testing procedures for VLSI circuits. (L2)
CO4	Analyze the algorithms of partitioning, placement and routing (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3		3					3			3	
CO2	3		3		3					3			3	
CO3	3	3								3			3	
CO4	3	3								3			3	
Average* (Rounded to nearest integer)	3	3	3	3	3					3			3	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Types of ASICs:** Full-Custom ASICs, Standard-cell-based ASICs, Gate array-based ASICs, channelled gate array, channel less gate array, structured gate array, programmable logic devices, field programmable gate arrays, design flow, case study. ASIC Cell Libraries. ASIC library design: transistors as resistors, transistor parasitic capacitance	CO1
II	**Verilog:** Basics of the Verilog language, operators, hierarchy, procedures and assignments, timing controls and delay, logic-gate modeling, modelling delay, altering parameters. **Logic Synthesis**: A logic-synthesis example, MULTIPLEXER, inside a logic synthesizer verilog and logic synthesis.	CO2
III	**Simulation:** Types of simulation, MUX example, logic systems, how logic simulation works, delay models, static timing analysis, switch-level simulation, transistor-level simulation.	CO2

IV	**Test:** The importance of test, boundary-scan test, faults, fault simulation, automatic test-pattern generation, scan test, built-in self-test, a simple test example.	CO3
V	**ASIC Construction:** Physical design, system partitioning, partitioning methods. **Floor planning and Placement**: Floor planning, placement, physical design flow, **Routing:** Global routing, detailed routing,	CO4

Learning Resources
Text Books
1. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Pearson Education, 2001.
Reference Books
1. Jan. M. Rabaey, Digital Integrated Circuits, 2/e, Prentice Hall, 2001 2. Sabih Gerez, Algorithms for VLSI Design Automation, Wiley, 1999. 3. Wayne Wolf, Modern VLSI Design, 4/e, Pearson Education, 2002. 4. Samir Palnitkar, Verilog HDL, 2/e, Pearson Education, 2003

RF CIRCUIT DESIGN

Course Code	19EC4605D	Year	III	Semester	II
Course Category	Program Elective-III	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Electronic Devices and Amplifier Circuits (19EC3305)
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret the properties of active and passive components at high frequency applications (L2)
CO2	Develop transmission lines used in RF circuit design (L3).
CO3	Build independent and interconnected networks (L3).
CO4	Analyze characteristics of transistor amplifiers for RF applications (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	1								1	2
CO2	3	2	3	2	2								2	3
CO3	2	3	3	2	3								2	3
CO4	2	3	3	3	2								3	3
Average* (Rounded to nearest integer)	2	3	3	2	2								2	3

Syllabus

Unit No.	Contents	Mapped CO
I	**Introduction:** Importance of Radio Frequency Design, Dimensions and Units, frequency Spectrum. RF behavior of Passive Components-Resistors, Capacitors and Inductors at high frequency. Chip Components and Circuit Board Considerations-Chip Resistors, Chip Capacitors, Surface-Mounted inductors. RF circuit Manufacturing Processes	CO1

II	**Active RF Components:** Semiconductor Basics – Physical Properties of Semiconductors, the PN-Junction, Schottky Contact. RF Diodes-Schottky Diode, PIN Diode, Varactor Diode, Tunnel Diode. Bipolar-Junction Transistor - Construction, Functionality and Frequency Response. RF Field Effect Transistors - Construction, Functionality, Frequency Response. Metal Oxide Semiconductor Transistors-Construction, Functionality	CO1
III	**Transmission Line Analysis:** Examples of Transmission Lines – Two-Wire Lines, Coaxial Line, Microstrip Lines. Equivalent Circuit Representation, basic laws, Circuit parameters for a Parallel –Plate Transmission Line. General Transmission line equation, characteristic impedance, lossless transmission line model, Microstrip Transmission lines	CO2
IV	**Single and Multiport Networks:** Basic definitions, interconnecting networks-series and parallel connection of networks, Cascading networks, ABCD network representation. Network properties and applications-inter relations between parameter sets. Scattering Parameters-Definition of S-parameters, chain scattering matrix	CO3
V	**RF Transistor Amplifier Design:** Characteristics of Amplifiers – Amplifier Matching Basics, Power amplifiers, Broadband Amplifiers, High Power Amplifiers, multistage amplifiers.	CO4

Learning Resources
Text Books
1. RF Circuit Design: Theory and applications by Reinhold Ludwing and Gene Bogdnov Pearson Education Asia Publication, New Delhi 2001 2. Secrets of RF Design by Joseph Carr., 3rd Edition, Tata McGraw-Hill Publishing Company Limited.
Reference Books
1. Radio frequency and microwave electronic illustrated Mathew M. Radmanesh, 2001, Pearson Education.
e- Resources & other digital material
1. https://nptel.ac.in/courses/117/102/117102012/#

PVP 19

SOFTWARE DEFINED RADIO

Course Code	19EC4602E	**Year**	III	**Semester**	II
Course Category	**Programme Elective-III**	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Basic knowledge of Signal processing and communication
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understandrequirements, benefits and different models for Software Defined Radio.
CO2	Understand in detail about Software Defined Radio Architecture for performance optimization.
CO3	Acquire complete knowledge regarding functioning of different blocks associated with Software Defined Radio.
CO4	Design circuits at different multirate signalling technique for frequency conversion and sampling issues.

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3												2
CO2	3	3	3	3	3	2						1		2
CO3	3	3	3	3	3	2						1		2
CO4	3	3	3	3	3	2						1		2
Average* (Rounded to nearest integer)	3	3	3	3	3	2						1		2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction**: The requirement for software defined radio, the benefits of multi-standard terminals, operational requirements, business models for software defined radio, new base station and network architectures, smart antenna systems.	CO1
II	**Basic Architecture of a Software Defined Radio**: Software defined radio architectures; Ideal Software defined radio architectures, Required hardware specifications, Digital aspects of a Software Defined radio, Current technology limitations.	CO2

III	**Flexible RF receiver architectures**: Receiver architecture options, implementation of a digital receiver: frequency up conversion using under sampling, achieving processing gain using oversampling, Noise figure, Receiver sensitivity, ADC spurious signals.	CO3
IV	**Multi-Band and General Coverage Systems**: Multiband Flexible receiver design, The problem of the Diplexer, Achieving Image rejection, Dynamic range enhancement, feedback and feed forward techniques	CO3, CO4
V	**Flexible transmitters and Power amplifiers**: Analog quadrature up conversion, quadrature up conversion with interpolation, Interpolated band pass up conversion, PLL based transmitters, Active All-pass filter, Use of high pass and low pass filters, Polyphase filtering.	CO3, CO4

Learning Resources
Text Books
1. P Kenington, "RF and Baseband Techniques for Software Defined Radio", Artec House,2005
Reference Books
1. Jouko Vanakka, "Digital Synthesizers and Transmitter for Software Radio", Springer,2005 2. Wally H. W. Tuttlebee, "Software Defined Radio: Baseband Technologies for 3G Handsets and Base stations", John Wiley & sons, 2003.
e-Resources: 1. https://en.wikipedia.org/wiki/Software-defined_radio 2. https://www.wiley.com/en- 3. us/Software+Defined+Radio%3A+Architectures%2C+Systems+and+Functions-p-9780470851647

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FIBER OPTIC SENSORS AND APPLICATIONS

Course Code	19EC4605F	**Year**	III	**Semester**	II
Course Category	Program Elective	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand an optical fiber communication link. (L2).
CO2	Analyze the characteristics of LED&LASER sources and Photo detectors (L4).
CO3	Identify the industrial applications of Optical Fibers.(L3)
CO4	Develop an Optical Network (L3).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3								1		2
CO2	2	3	2	2								2		1
CO3	3	2	3	3								2		2
CO4	2	3	2	3								1		1
Average* (Rounded to nearest integer)	3	3	3	3								2		2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Propagation of EM waves in Optical fibers:** Fiber optic communication system, Light propagation through fibers, Acceptance angle, Numerical Aperture, Types of fibers and their properties - step index, graded index, single mode & multimode, Losses in optical fibers-Absorption, Attenuation, Scattering and Dispersion losses.	CO1
II	**Optical Sources:** LED- Principle of operation, LED materials, power and efficiency calculation, LED structures- Homostructure, Heterostructure, LED types-surface emitting and edge emitting LEDs – and their characteristics. LASER-Fundamental characteristics, three level and four level lasers-Properties of lasers-Laser modes-Resonator configuration, Types of lasers - Gas laser, solid laser, liquid laser, semiconductor laser.	CO2

III	**Photo detectors:** Performance and compatibility requirements for detectors, Optical detection principles, Quantum efficiency, responsivity, noise and gain calculation of detectors, P-i-N photodiodes, Avalanche photodiodes, Quantum-dot photo detectors, Phototransistors.	CO2
IV	**Industrial applications of Optical Fibers and LASERS:** Mach-Zehnder Interferometric sensor, fiber optic gyroscope, distributed fiber optic sensor-OTDR, LIDAR, measurement of pressure, temperature, current and liquid level, Material processing-Laser heating, removal and vaporization. Holography - Basic principle, Holographic interferometer, applications –Holography for non-destructive testing-Medical applications of lasers.	CO3
V	**Fiber Optic networks and IOT** Optical Networking: Network terminology, Network categories, network layers, Network topologies, SONET/SDH-Networks, High-speed light wave links, Building blocks of IOT enabling technologies, characteristics of IOT systems, physical and logical design of IOT, Data acquisition using sensors, camera, GPS, Smart phone.	CO3

Learning Resources

Text Books

1. Optical Fibre Communications Principles and Practice, Third edition John M. Senior, PearsonEducation Limited 2009.
2. Optical Fibre Communications, fourth edition, Gerd Keiser, Tata McGraw Hill EducationPrivate Limited, 2012.
3. Industrial lasers and their applications, John and Harry, McGraw Hill, 1974.
4. Internet of Things: A Hands-On Approach by Arshdeep Bahga, Vijay Madisetti, 2014.

Reference Books

1. Optical electronics foundation book, Ghatak A.K. and Thiagarajan K, TMH, New Delhi,1991.
2. Fibre Optic Communications, Joseph C. Palais, 5th Edition, Pearson Education, 2008.
3. Introduction to lasers and their applications, D.C.O'shea, Russel Callen, Mc Millan, 1977.
4. Industrial applications of lasers, John F Ready, Academic press, 1978.

e- Resources & other digital material

1. https://onlinecourses.nptel.ac.in/noc21_ee40/preview

PVP 19

ENGINEERING ETHICS

Course Code	19MC1601	**Year**	III	**Semester**	II
Course Category	Mandatory Course	**Branch**	ECE	**Course Type**	Theory
Credits	0	**L-T-P**	3-0-0	**Prerequisites**	--
Continuous Internal Evaluation:	100	**Semester End Evaluation:**	--	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Improve knowledge of ethics
CO2	High sense of responsibility
CO3	Environmental awareness
CO4	Professional outlook
CO5	Developing a broad culture.

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								3				2		
CO2								3				3		
CO3								3				3		
CO4								3				1		
CO5								3				2		
Average* (Rounded to nearest integer)								3				3		

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Engineering ethics – Definition, Three types of Engineering ethics Rights and responsibilities of an engineer, Evolution of engineering ethics	CO1
II	Code of ethics, Kohlberg's theory, Gilligan's theory	CO1, CO2
III	Engineering as social experimentation Engineer's social responsibility Technological Optimism: The promise Of Technology	CO1, CO3
IV	Computer ethics, Ethical hacking, Computer Privacy Impact of globalization on Computer ethics	CO1, CO4
V	Environmental ethics. and its significance, Sustainable Development, Technology assessment	CO1, CO4,CO5

Learning Resources
Reference Books
1. Ethics in engineering: Mike W.Martin Roland, Mac Grow Hill.Schinzinger 2. Engineering ethics-----M.Govindarajan, S.Natarajan & V.S.Senthil Kumar. Eastern economy Edn. PHI 3. Engineering ethics---Harris pitch and Rabbins, Cengage. 4. Caroline whit back---Ethics in engineering practice and research: Cambridge.
e- Resources & other digital material
1. 1. http://nptel.ac.in/courses.php 2. http://jntuk-coeerd.in/

PVP 19

ENVIRONMENTAL MANAGEMENT

Course Code	19ES5601A	**Year**	III	**Semester**	II
Course Category	Open Elective II	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	--
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
After successful completion of the course, the student will be able to	
CO1	Understand environmental management principles in relation to sustainable development & Economic sustainability. (L2)
CO2	Apply critically theoretical and conceptual issues relating to environmental.(L3)
CO3	Analyze & undertake research that will allow to articulate in both oral and written form and for appraisal of contemporary environmental management decision-making. (L4)
CO4	Analyze & Employ project management processes and analytical tools to achieve a sustainable outcome to environmental problems. (L4)
CO5	Apply knowledge to Prepare technical papers/briefings to communicate risk/solutions to stakeholders.(L3)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2							
CO2	3						2							
CO3	3						2							
CO4	3						2							
CO5	3						2							
Average * (Rounded to nearest integer)	3						2							

Syllabus		
UNIT NO	Contents	Mapped Cos
I	**The atmosphere and human activities** structure and composition of the atmosphere , Atmospheric pollution and causes describe and explain the causes, with reference to London smog, acid rain, ozone layer depletion, greenhouse effect, and their impact on people and environment ,Managing atmospheric pollution by people, governments and individuals to reduce the global impacts, Case study New Delhi Smog.	CO1 CO2

II	**Water and its management** Global water distribution state the distribution **,**Water quality and availability - water-rich and water-poor countries**,** Multipurpose dam projects –Impacts –case studies- chipko movement , Narmada bachavo andholan **,**Water pollution and its sources **,**Managing pollution of fresh water -Case study-Ganga River **,** Water related diseases and Management.	CO1 CO2
III	**Energy and the environment** Classify energy resources as non-renewable and renewable, Fossil fuel formation, Energy demands, Conservation and management of Non-renewable energy resources, Alternate energy sources to meet the present demand.	CO1 CO3
IV	**Managing natural hazards** Earthquakes and volcanoes Management - Case study, Earthquake management in California **,** Tropical cyclones- storms, hurricanes, typhoons-Case study Managing cyclone impact in Orissa, India , Flooding -Case study Flooding in Bangladesh, Drought -Case study Drought in the India.	CO1 CO4
V	**Techniques for investigation and examination** Investigation skills-EIA **,** Methods for local investigations – EIA statement ,Examination techniques-Policy framing- Odd and Even rule in Delhi**.(Using Software)**	CO1 CO5

Learning Recourses
Text Books
1. Agarwal, K.M., Sikdar, P.K., Deb., S.C (2005) A Text Book of Environment, Macmillan India Limited. 2. Sharma, R.D. (1976), Organisational Management, Light and Life Publishers, New Delhi. 3. Varma and Agarwal, Theory & practice of Management Forward Book Depot, New Delhi.
Reference Books
1. Kovntz, H and C. Danvel (1978): Essential of management, second edition, Tata Mc Graw Hill publishing company, New Delhi. 2. Erickson, P.A. (1977) Environmental Impact Assessment – Principles an3. Erickson, P.A. (1977)

PVP 19

TELECOMMUNICATION FOR SOCIETY

Course Code	19ES5601B	**Year**	III	**Semester**	II
Course Category	Open Elective II	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Analog Communications Digital Communications
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Infer the basic knowledge of telecommunication system, regulation and standards of telecom regulatory bodies (L2).
CO2	Able to deduce cost of different devices such as mobile, Wi-Fi and DTH operators and carry out investigation of Frequency Management and Business on Bandwidth. (L3).
CO3	Make use of revolutionary changes in mobile and wireless technologies to understand recent developments (L3).
CO4	Examine different optical communication components. (L4).
CO5	Justify the use of satellite orbits, different components and sub-systems in advanced communication systems (L4).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2								2	2	2
CO2	3	3	2	2								2	2	2
CO3	3	3	2	2								2	2	2
CO4	3	3	2	2								2	2	2
CO5	3	3	2	2								2	2	2
Average* (Rounded to nearest integer)	3	3	2	2								2	2	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Telecommunication Systems:** Telephones, Telephone System, Facsimile, Internet Telephony. Telecommunication Standards and Regulations - International telecommunication union (ITU) - TRAI and its role – Frequency management – Cost computations – Mobile and DTH operations – Role of wireless planning commission (WPC) for telecommunications in India.	CO1

II	**Telecom business management:** Automated teller machines – Teleconferencing – Telecommuting –Customer oriented communication aspects – Telecom billing - Concepts of data rate and bandwidth requirements – Digital subscriber line – Broadband technologies – Digital home – Voice enabled DSL.	CO2
III	**Cell Phone Technologies**: Cellular Telephone Systems, A Cellular Industry Overview, 2G and 3G Digital Cell Phone Systems, Long Term Evolution and 4G Cellular Systems **Wireless Technologies:** Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless Networks,WiMAX and Wireless Metropoli tan-Area Networks	CO3
IV	**Optical Communication:** Optical Principles, Optical Communication Systems, Fiber-Optic Cables, Optical Transmitters and Receivers.	CO4
V	**Satellite Communication:** Satellite Orbits, Satellite Communication Systems, Satellite Subsystems, Ground Stations, Satellite Applications, Global Navigation Satellite Systems.	CO5

Learning Resources
Text Books
1. Louis E. Frenzel Jr., Principles of Electronic Communication Systems, 4/e, Mc Graw Hill Publications, McGraw-Hill Education, 2016. 2. Willium C. Y. Lee, "Wireless & Cellular Telecommunications", McGraw-Hill Companies Inc, Third Edition, 2006.
Reference Books
1. Wayne Tomasi, Electronic Communication Systems, 5/e, Pearson Education, 2009. 2. Wayne Tomasi, Advanced Electronic Communication Systems, 4/e, Pearson Education, 2013. 3. Dennis Roddy, Electronic Communications, 4/e, Pearson Education, 2003.

PVP 19

GERMAN FOR BEGINNERS

Course Code	19HS5601A	Year	III	Semester	II
Course Category	Open Elective II	Branch	Common to all	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	NIL
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Learn basics of German Language and develop a consciousness for the cultural background of the language.
CO2	Understand authentic texts/ announcements in German
CO3	Express themselves according to the situations and to give/seek information in German
CO4	Read and respond to an extract from a story, an e-mail message or song or simple text
CO5	Write the spellings correctly and sentences in a grammatically correct form

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										2				
CO2										2				
CO3										2				
CO4										2				
CO5										2				
Average* (Rounded to nearest integer)										2				

SYLLABUS		
UNIT NO.	**CONTENT**	**Mapped CO**
I	Alphabets, Numbers, Basic Vocabulary, German States & Its Culture	CO1,CO2
II	Modal Verbs, Separable and Inseparable Verbs, Transitive and Intransitive Verbs, Verb Conjugation.	CO1,CO2 CO3
III	Adverbs, Prepositions, Personal Pronouns, Adjectives	CO3
IV	Present Tense, Past Tense, Future Tense	CO3,CO4 CO5
V	The Nominative Case, Accusative Case, Dative Case, Genitive Case, The Imperative	CO3,CO4 CO5

Learning Resources

Text Book

1. Netzwerk A1 Deutsch als Fremdsprache by Goyal Publications, New Delhi

E- Resources & other digital material:

1. https://learngerman.dw.com/en/overview
2. https://onlinecourses.nptel.ac.in/noc22_hs30/
3. https://app.memrise.com/German-1

PVP 19

ANALYTICAL ESSAY WRITING

Course Code	19HS5601C	Year	III	Semester	II
Course Category	Open Elective II	Branch	Common to all	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	NIL
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the meaning of analysis and how to analyze the content of essays, paragraphs, reviews, books, articles etc. (L2)
CO2	Classify various types of analytical topics according to context and make reports. Organize the topic and prepare hypothesis (L3)
CO3	Construct meaningful arguments by following thematic information and suitable language.(L3)
CO4	Analyze thesis statement, topic sentences, evidence, and supporting ideas. (L4)
CO5	Distinguish the general essays from analytical essays and reorganize the content.(L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2										3		2		
CO3										3		2		
CO4										3		1		
CO5										3		3		
Average* (Rounded to nearest integer)										3		2		

SYLLABUS		
UNIT NO.	CONTENT	Mapped CO
I	Identifying the topic sentences – meaning of analysis – History of essay writing – Different types of essays – Role of analytical essays	CO1, CO5
II	Fundamental prose skills – explore the content – discover various approaches in writing essays – Hypothesis of the topic or research	CO 1, CO2, CO5
III	Discussing and emulating different topics – traditional methods of essay writing – sophisticated way to present the topics	CO 1, CO3 ,CO4
IV	Analyze the essays – anthology of essays – Using analytical essays in different contexts – Competitive exams orientation – Comprehensive questions	CO1, CO4,CO5
V	Types of essays – differentiation of essays – contemporary essayists like Hazlitt, David Foster Wallace, Montaigne, Jawaharlal	CO1,CO2, CO5

	Nehru, Jiddu Krishna Murthy, Iris Murdoch, Woolf Bacon, RW Emerson, Samuel Johnson, George Orwell, James Baldwin, Agatha Christie, Jane Austen etc.	

Learning Resources
Reference Books
1. Ariel Levy, ed., The Best American Essays 2015, Houghton Mifflin, 2015 2. Philip Lopate, ed., The Art of the Personal Essay (Anchor Books 1997) 3. David Foster Wallace, Consider the Lobster and Other Essays, Back Bay Books, 2007 4. Revising Prose by Richard Lanham 5. 100 ways to improve your writing by Gary Provost 6. Bird by Bird by Anne Lamott 7. The Sense of Style by Steven Pinker
e- Resources & other digital material:
1. https://canvas.harvard.edu/courses/8124 2. https://boomessays.com/blog/how-write-analytical-essay#definition 3. https://www.ranker.com/list/best-essayists/ranker-books

PVP 19

INDIAN ECONOMY

Course Code	19HS5601D	Year	III	Semester	II
Course Category	Open Elective II	Branch	Common to all	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	NIL
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	To understanding of the fundamental concepts Indian economy and theoretical background.
CO2	The ability to apply knowledge to evaluate the impact of the population, unemployment and poverty on the economic development.
CO3	To understanding of the role of public and private sector in the Indian economy.
CO4	To awareness on structure and growth of capital market in India industrial growth, how to align the management of a supply chain with corporate goals and strategies.
CO5	The capability in the analyse Public expenditure trends, issues and Assessment of Indian planning.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2								3	3	
CO2	3	3		2								3	3	
CO3	3	3		2								3	3	
CO4	3	3		2								3	3	
CO5	3	3		2								3	3	
Average* (Rounded to nearest integer)	3	3		2								3	3	

SYLLABUS

UNIT NO.	CONTENT	Mapped CO
I	**Economic Development: A theoretical back ground:** Economic growth, development and underdevelopment, characteristics of under developed and developing countries. Nature of the Indian economy, role of natural resources in economic development. Environmental protection and sustainable development.	CO1
II	**Population and Human Development:** Indian population size and growth trends, reasons of the rapid growth of population, population and economic development. Employment and unemployment in India, the concept of poverty and rural poverty, income distribution in India	CO2

III	**Industrial sector and services in Indian economy:** various industrial policies, role of public and private sector in the Indian economy, LPG policy 1991, Industrial sickness in India, foreign trade and foreign capitals, Balance of payments, WTO and India.	CO3
IV	**Money and banking:** characteristics of the Indian money market, price trends and inflation, commercial banking in India. Capital market in India, structure and growth of capital market in India industrial growth, RBI, Evolutional of institutional financing in India.	CO4
V	**Public finance, Economic planning and policy:** fiscal policy and monetary policy, Indian tax structure. Public expenditure trends and issues. **Economic planning and policy:** Evaluation of the objectives of economic planning, important features of Indian plans, Assessment of Indian planning.	CO5

LEARNING RESOURCES
Text Books
1. Misra and Puri Indian economy Himalaya Publishing House twenty eight revised and updated edition 2010 2. T. Dyson, 2008,–India's Demographic Transition and its Consequences for Development in Uma Kapila, editor, Indian Economy Since Independence, 19th edition, Academic Foundation 3. Dr. S.K. Singh/Prof. T.N. Jha / Dr. Vinita Singh Economic Development 21st Century Edition 4. A. Musgrave and P.B. Musgrave, Public Finance in Theory &Practice, McGraw Hill Publications, 5th edition, 1989.

PVP 19

PUBLIC ADMINISTRATION

Course Code	19HS5601E	**Year**	III	**Semester**	II
Course Category	Open Elective-II	**Branch**	Common to all	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	NIL
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes		**Level**
Upon successful completion of the course, the student will be able to:		
CO1	Describe the scope and significance of public administration	L2
CO2	Explain different administrative thoughts.	L2
CO3	Illustrate accountability and control over administration by different groups in society	L2
CO4	Explain the concepts of union and state government administration	L2
CO5	Summarize the administration process in civil services	L2

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1						2		3	3		1			2
CO2						2		3	3		1			2
CO3						2		3	3		1			2
CO4						2		3	3		1			2
CO5						2		3	3		1			2
Average* (Rounded to nearest integer)						2		3	3		1			2

Syllabus		
UNIT NO.	**Course Content**	**Mapped COs**
I	**Introduction:** Meaning scope and significance of public administration, evolution of discipline and its present status, challenges of liberalization, privatization and globalization, good governance, electronics governance and applications, New Public Management(NPM)	CO1
II	**Administrative Thought:** Scientific management theory, classical theory, bureaucratic theory, human relation theory, system theory	CO2
III	Accountability and Control: Legislative, executive and judicial control over administration, role of media, interest groups, NGOs, civil society, Right to Information ACT(RTI), social audit, citizen chapters.	CO3
IV	Union and State Government Administration: President, prime minister , council of ministers, cabinet, central and state secretariats, boards and commissions, governor, chief minister and council of ministers, central state relations, finance commission, Neeti ayog	CO4

V	Civil Services: Recruitment, training and other condition of services, district administration, role of collector, local self-governing institutes – 73rd and 74th constitutional amendments act.	CO5

Learning Resources
Text Books
1. Avasti, Maheswari , Public Administration,31/e, Lakshmi Narain Agarwal books, india 2. B.L.Fadia, Kuldeep faida, Indian administration, 8/e Sahitya Bhawan, India, 2014.
Reference Books
1. Nicholas Henry, Public Administration and public affairs, 21/e Prentice Hall of India, 2012. 2. D. Ravindra Prasad , V.Sivalinga Prasad, P. Satyanarayana, Administrative Thinkers,2/e , Sterling Publishers,1991 3. D.D Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis Butterworth's, Wadhwa Nagpur, 2013. 4. Ramesh K Arora , Rajini Goyal Indian Public Administration, 3/e New Age International publishers India, 1995

PVP 19

NATIONAL SERVICE SCHEME

Course Code	19HS5601F	Year	III	Semester	II
Course Category	Open Elective-II	Branch	Common to all	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	NIL
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the community in which they work and their relation. (L2)
CO2	Identify the needs and problems of the community and involve them in problem-solving. (L3)
CO3	Develop capacity to meet emergencies and natural disasters. (L3)
CO4	Take part in national integration and social harmony. (L4)
CO5	Apply their knowledge in finding practical solutions to individual and community problems. (L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	2					1	1	
CO2						3	2					1	1	
CO3						3	2					1	1	
CO4						3	2					1	1	
CO5						3	2					1	1	
Average* (Rounded to nearest integer)						3	2					1	1	

SYLLABUS

UNIT NO.	CONTENT	Mapped CO
I	**National Service Scheme** A) History and its Objectives B) Organizational structure of N.S.S. at National, State, University and College Levels C) Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation.	CO1, CO2, CO5
II	**National Integration** A) Need of National integration B) Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc.	CO1 CO2, CO4

III	**N.S.S. Regular Activities** A) Traffic regulation B) Working with Police Commissioner's Office C) Working with Municipal Corporation of Vijayawada D) Working with Health Department E) Blind assistance F) Garments collection G) Non-formal education H) 'Environmental Education, Awareness and Training (EEAT)' I) Blood donation	CO1, CO3, CO4
IV	**Special Camping programme** A) Nature and its objectives B) Selection of camp site and physical arrangement C) Organization of N.S.S. camp through various committees and discipline in the camp. D) Activities to be undertaken during the N.S.S. camp. E) Use of the mass media in the N.S.S. activities.	CO1, CO3, CO5
V	**Special Programme** A) Legal awareness B) Health awareness C) First-aid D) Career guidance E) Leadership training - cum - Cultural Programme F) Globalization and its Economic Social Political and Cultural impacts.	CO1, CO2, CO5

Learning Resources
Text Book
1. National Service Scheme Manual, Government of India.
Reference Books
1. Training Programme on National Programme scheme, TISS. 2. Orientation Courses for N.S.S. Programme officers, TISS. 3. Case material as Training Aid for field workers, Gurmeet Hans. 4. Social service opportunities in Hospitals, Kapil K.Krishan, TISS. 5. Social Problems in India, Ram Ahuja.

PVP 19

PROFESSIONAL COMMUNICATION

Course Code	19HS5601G	Year	III	Semester	II
Course Category	Open Elective II	Branch	Common to all	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	NIL
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Communicate proficiently in interviews and all social situations. (L2)
CO2	Demonstrate an ability to use effective verbal and non-verbal communication skills. (L3)
CO3	Use the formats, strategies and possible content of business communication at work place.(L3)
CO4	Prepare professional documents including web related (On-line) communication. (L4)
CO5	Analyze texts, diagrams and improve both reading and writing skills which would help in academics as well as professional career.(L4)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2									3	3		3		
CO3									3	3		3		
CO4									3	3		3		
CO5									3	3		3		
Average* (Rounded to nearest integer)									3	3		3		

SYLLABUS		
UNIT NO.	**CONTENT**	Mapped CO
I	A) Verbal communication – conciseness, clarity, correctness B) Non-verbal communication – body language C) Barriers to communication D) Reading Short Passages, News Articles, Technical Papers and Short Stories - Note making and note taking.	CO1, CO2, CO5
II	A) Professional Letters – Purpose, Style and format. B) E- mail – format and etiquette. C) Presentation skills D) Group discussion	CO1, CO3, CO4

III	A) Technical Report writing – Types: Business/Technical, Components, Style and Formats – Writing a Technical Proposal. B) Administrative drafting and correspondence - Memos, Minutes and Web notes.	CO1, CO3, CO4
IV	A) Information transfer. B) Meeting skills C) Team dynamics	CO1,CO 2, CO5
V	A) Job application - Resume – Structure of Resume/CV – covering letter – writing SOPs. B) Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online interviews, one-to-one interview & panel interview, FAQs related to job interviews, answering strategies.	CO1,CO 2, CO4

LEARNING RESOURCES

Reference Books:

1. Basu B.N. Technical Writing, 2011 Kindle edition
2. C Muralikrishna & Sunitha Mishra, Communication Skills for Engineers, 2nd edition, NY: Pearson, 2011.
3. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
4. Skilful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.

e- Resources & other digital material:

1. https://www.britishcouncil.org/english
2. 2http://www.5minuteenglish.com/
3. http://www.bbc.co.uk/learningenglish/
4. http://www.better-english.com/
5. http://www.nonstopenglish.com/
6. https://www.usingenglish.com/comprehension/
7. https://www.englishclub.com/reading/short-stories.htm
8. https://www.english-online.at/
9. https://www.englishclub.com/
10. http://www.world-english.org/http://learnenglish.britishcouncil.org/

Online Dictionaries:
Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

PVP 19

BASICS OF FINANCE

Course Code	19HS5601H	Year	III	Semester	II
Course Category	Open Elective II	Branch	Common to all	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	NIL
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	To understanding of the basics of finance and objective of finical management
CO2	The ability knowledge in financial planning and implementation of financial plans
CO3	To understanding problems of over-capitalisation and under-capitalisation
CO4	To know about time value of money and financial forecast
CO5	The capability to analyse various sources of loans and identify the best source of loan for finance.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2								3	3	
CO2	3	3		2								3	3	
CO3	3	3		2								3	3	
CO4	3	3		2								3	3	
CO5	3	3		2								3	3	
Average* (Rounded to nearest integer)	3	3		2								3	3	

SYLLABUS

UNIT NO.	CONTENT	Mapped CO
I	**Introduction:** Business Finance Defined-Traditional and Modern Views; Scope and Functions of Finance; Finance Function vs. Accounting Function; Objectives of Financial Management-Profit Maximization vs. Wealth Maximization.	CO1
II	**Financial Planning:** Concept of Financial Planning; Process of Financial Planning; Characteristics of Sound Financial Plans; Factors Affecting Financial Plan.	CO2
III	**Capitalisation and Capital Structure**: Concept, Nature and Scope of Capitalisation; Earnings Theory and Cost Theory of Capitalisation; Over-Capitalisation; Under-Capitalisation; Capital Structure Theories and Factors Determining Capital Structure	CO3

IV	**Financial Forecasting and Time Value of Money**: Concept of Financial Forecasting; Sales Forecast; Income Forecast; Financial Position Forecast; Forecasting for Growth and External Funds Requirements; Time Value of Money-Discounting and Compounding.	CO4
V	**Pattern of Capital Requirements**: Long-Term and Medium-Term Financing – Purpose, Sources and Instruments; Short-Term Financing-Purpose, Sources and Instruments.	CO5

Learning Resources

Text Books

1. Brealey, Richard A and Steward C. Myers: Corporate Finance, McGraw Hill, Int. Ed., New York.
2. Chandra, Prasanna: Financial management, Tata Mc Graw Hill, Delhi.
3. Hampton, John: Financial Decision Making, Prentice Hall, Delhi.
4. Pandey, I.M.: Financial Management, Vikas Publishing House, Delhi.
5. Van Horne, J.C. and J.M. Wachowicz Jr. : Fundamentals of Financial Management, Prentice-Hall, Delhi

Reference Books

1. Van Horne, James C Financial Management; Harper and Row, New York.
2. Pinches, George E: Essentials of Financial Management; Harper and Row, New York.
3. Khan MY, Jain PK: Financial Management; Tata McGraw Hill, New Delhi.
4. Archer, Stephen, H., Chate G Marc, Racette, George; Financial management; John Wiley, New York
5. Block, Stanley B, Geoffrey A Hilt: Foundations of Financial Management; Richard D. Irwin, Homewood

PVP 19

BASICS OF MARKETING

Course Code	19HS5601I	**Year**	III	**Semester**	II
Course Category	Open Elective II	**Branch**	Common to all	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	NIL
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to:	
CO1	Understand issues of marketing with an emphasis on learning to develop responsive marketing strategies that meet customer needs
CO2	Make use of the key analytical frameworks and tools used in marketing in relation to segmenting and targeting of products
CO3	Get acquainted with the components of marketing mix, stages in new product development
CO4	Analyse the objectives and methods for pricing products and selecting channel members
CO5	Evaluate the techniques of promotion mix

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H-High3, M-Medium-2, L- Low-1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							3	3	2			3		3
CO2							3	3	2			3		3
CO3							3	3	2			3		3
CO4							3	3	2			3		3
CO5							3	3	2			3		3
Average* (Rounded to nearest integer)							3	3	2			3		3

SYLLABUS		
UNIT NO.	**CONTENT**	Mapped CO
I	Introduction to Marketing: Definition, Nature, Scope, Importance of Marketing, Core Concepts of Marketing, Philosophies of Marketing.	CO1
II	Market Segmentation, Targeting and Positioning: Definition, Levels of Segmentation, Bases of Segmentation, Target Market, Positioning Strategies.	CO2
III	Marketing Mix:4P's, Classification of Products, Product Life Cycle (PLC)-Stages, New Product Development(NPD)- Types, Process	CO3
IV	Pricing: Definition, Objectives, Pricing Strategies- Channels of Distribution: Definition, Functions, Levels	CO4
V	Promotion Mix: Definition, Objectives, Importance, Elements, Integrated Marketing Communication(IMC)	CO5

Learning Resources
Text Books
1. Philip Kotler, Gary Armstrong and Prafulla Agnihotri, Principles of Marketing, Pearson India, 17th Edition. New Delhi: 2018 2. Rajan Saxena, Marketing Management, Tata-McGraw Hill, Fifth Edition New Delhi :2015
Reference Books
1. Etzel, Walker, Stanton &Pandit, "Marketing Concepts & Cases", Tata McGraw Hill, New Delhi. 2. Govindarajan M., "Marketing Management, Concepts, Cases, Challenges and Trends", PHI Private Limited, New Delhi, 2007. 3. Karunakaran, "Marketing Management", Himalaya Publishing House, Mumbai. 4. Charles W. Lamb, Joseph F. Hair, Carl McDaniel, Harish Kapoor, Henry Klaise "MKTG", Cengage Learning, New Delhi, 2012.
e- Resources & other digital material
1. https://nptel.ac.in/courses/110/104/110104068/ 2. https://nptel.ac.in/courses/110/107/110107147/ 3. https://nptel.ac.in/courses/110/104/110104070/

PVP 19

MICROPROCESSORS AND MICROCONTROLLERS LAB

Course Code	19EC3651	Year	III	Semester	II
Course Category	Program Core	Branch	ECE	Course Type	Lab
Credits	1.5	L-T-P	0-0-3	Prerequisites	Computer Architecture and Organization
Continuous Internal Evaluation:	25	Semester End Evaluation:	50	Total Marks:	75

Course Outcomes		BT Level
Upon successful completion of the course, the student will be able to		
CO1	**Develop** programs using different class of instructions for 8086 microprocessor and ARM processor.	L3
CO2	**Analyse** assembly language programs; select appropriate IDE and assemble into machine of a microprocessor and microcontroller.	L4
CO3	**Design** electrical circuitry to the Microcontroller I/O ports in order to interface with the external devices.	L6
CO4	**Make** an effective lab report.	L6

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
*** - Average value indicates course correlation strength with mapped PO**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2				1	1			2	2
CO2	3	3	2	2	2				1	1			2	2
CO3	3	3	2	2	2				1	1			2	2
CO4	3	3	2	2	2				1	1			2	2
CO5	3	3	2	2	2				1	1			2	2
Average* (Rounded to nearest integer)	3	3	2	2	2				1	1			2	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
	Experiments with microprocessor 8086 using Assembler:	
1	Arithmetic operations on 8 bit and 16 bit operands	CO1, CO2, CO4
2	Transfer block of data from one memory location to another memory location.	CO1, CO2, CO4
3	Programs using monitor routines.	CO1, CO2, CO4
4	Compute maximum, minimum and sorting (ascending and descending).	CO1, CO2, CO4
5	Generate Fibonacci series, average of N numbers, factorial of N.	CO1, CO2, CO4
	Experiments with ARM CORTEX M3 Processor using KEIL MDK ARM	

6	A program to toggle LED every second using timer interrupt	CO1, CO2, CO3,CO4
7	A program to interface stepper motor and rotate it in clockwise and anti-clockwise direction.	CO1, CO2, CO3,CO4
8	Display the Hex digits 0 to F on a 7-segment LED interface with an appropriate delay in between	CO1, CO2, CO3,CO4
9	Interface a 4x4 keyboard and display the key code on an LCD	CO1, CO2, CO3,CO4
10	Write a program to utilize internal PWM module and generate PWM and vary its duty cycle	CO1, CO2, CO3,CO4

Learning Resources

Text Books

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition.
2. ARM Microprocessor Systems – Cortex – M Architecture, Programming, and Interfacing by Muhammad Tahir and Kashif Javed, CRC Press.
3. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph You

Reference Books

1. Embedded Systems Fundamentals with ARM Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media
2. Cortex -M3 Technical Reference Manual

PVP 19

VLSI DESIGN LAB

Course Code	19EC3652	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	LAB
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Digital Circuits
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Design, Simulate & test the various Combinational logic circuits using Verilog (L6)
CO2	Design, Simulate & test the various Sequential logic circuits using Verilog (L6)
CO3	Design, Simulate & test arithmetic logic circuits using Verilog (L6)
CO4	Design, Simulate & test memories using Verilog (L6)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	3								3	
CO2	3	2	3	2	3								3	
CO3	3	2	3	2	3								3	
CO4	3	2	3	2	3								3	
Average* (Rounded to nearest integer)	3	2	3	2	3								3	

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
Simulate the internal structure of the following Digital IC's using VERILOG and verify the operations of the Digital IC's (Hardware) in the Laboratory		
I	Realization of Logic Gates	CO1
II	3 to 8 Decoder -74x138	CO1
III	8 x 1 Multiplexer-74x151 and 2x 4 De-multiplexer-74x155	CO1
IV	BCD to 7-segment Decoder 74x49	CO1
V	4- Bit comparator-74x85	CO1
VI	4-Bit Binary Adder 74x83	CO3
VII	D Flip-Flop-74x74	CO2
VIII	Decade counter -74x90	CO2
IX	4 Bit counter-74x93	CO2
X	Shift registers-74x95	CO2
XI	Universal shift registers-74x194/ 195	CO2
XII	RAM (16 x 4)-74x189 (Read and Write operations)	CO4
XIII	4-Bit ALU Design – 74x181	CO3

Learning Resources
Text Books
1. Charles H. Roth, Lizy Kurian John, Byeong Kil Lee, Digital Systems Design using Verilog, 1/e, Cengage Learning, 2016.
Reference Books
1. Kang, Leblibici, CMOS Digital Integrated Circuits, 3/e, Tata McGraw Hill, 2001. 2. Jan M. Rabaey, Digital Integrated Circuits, 2/e, Pearson Education, 2002. 3. Jackson, Hodges, Analysis and Design of Digital Integrated Circuits, 3/e, Tata McGraw Hill, 2010.
e-Resources
1. https://nptel.ac.in/courses/106/105/106105165/

PVP 19

DESIGN PRACTICE LAB

Course Code	19EC3653	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Nil
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Demonstrate USRP Concepts (L2)
CO2	Develop and Implement Analog Communication Concepts using USRP (L3)
CO3	Develop and Implement Digital Communication Concepts using USRP (L3)
CO4	Build FM Radio Receiver. (L3)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2					1		1	2	1
CO2	3	3	2	2	2					1		1	2	1
CO3	3	3	2	2	2					1		1	2	1
CO4	3	3	2	2	2					1		1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2					1		1	2	1

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	Introduction to the USRP	CO1
II	Develop and Implement AM Transmitter/Receiver using USRP	CO2
III	Implementation of Frequency Division Multiplexing using USRP	CO2
IV	Image Rejection with complex filtering using USRP Modules	CO2
V	Develop and Implement DSBSC modulator/demodulator	CO2
VI	Implementation of FM Transceiver using USRP Modules	CO2
VII	Implementation of ASK Transceiver using USRP Modules	CO3
VIII	Implementation of FSK Transceiver using USRP Modules	CO3
IX	Implementation of PSK Transceiver using USRP Modules	CO3
X	Examine the Impact of Inter Symbol Interference on Eye Diagram	CO3
XI	Implementation of adaptive Equalizers using USRP Modules	CO3
XII	Implementation of QPSK Transceiver using USRP Modules	CO3

Learning Resources
Text Books
1. Introduction to Analog and Digital Communication System-Simon Haykin, John Wiley and Sons, 3rd Ed., 2009. 2. Fundamentals of Communication Systems - John G. Proakis, Masoud Salehi, PEARSON, 2nd Ed., 2013
Reference Books
1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 3rd Ed.,2007 2. Analog and Digital Communication System-Sam Shanmugam, John Wiley and Sons,3rd Edition,2009

PVP 19

IV YEAR

PVP 19

ORGANIZATIONAL BEHAVIOUR

Course Code	19HS1701	**Year**	IV	**Semester**	I
Course Category	Humanities	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Demonstrate the applicability of the concept of organizational behaviour to understand the behaviour and culture of people in the organization. L2
CO2	Demonstrate the applicability of analysing the complexities associated with management of individual behaviour in the organization. L2
CO3	Analyse the complexities associated with management of the group behaviours (Group Dynamics) in the organization and role of leadership. L4
CO4	Demonstrate how the organizational behaviour can integrate in understanding the motivation for creating positive work culture. L2
CO5	Demonstrate how the organizational behaviour can influence in understanding the importance of learning and leadership for an organization to create positive impact. L2

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								3	3		2			3
CO2								3	3		2			3
CO3								3	3		2			3
CO4								3	3		2			3
CO5								3	3		2			3
Average* (Rounded to nearest integer)								3	3		2			3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Organizational Behaviour:** Definition of Organizational Behaviour-Nature and Scope of Organizational Behaviour-Opportunities of Organizational Behaviour-Linkage of Organizational Behaviour with other disciplines-Organizational Behaviour Models	**CO1**
II	**Foundations of Individual Behaviour: Perception:** Definition of Perception-Factors of Perception- The Perception Process-**Motivation:** Definition of Motivation-Theories of Motivation: Maslow's Hierarchy Theory of Needs-Herzberg's Two-Factor Theory-Mc Gregor's Theory	**CO2**

	of Motivation-**Learning:** Definition Learning- Objectives of Learning- Process of Learning- Theories of Learning-Classical conditioning theory- Operant conditioning theory.	
III	**Personality Development and Leadership: Personality Development-** Definition of Personality-Objectives of Personality- Dimensions of Personality- Stages of Personality Development- **Leadership**- Definition of Leadership – Objectives of Leadership – Styles of Leadership in Organization	**CO3**
IV	**Formation of Teams and Group Dynamics: Formation of Teams-** Definition of Team- Objectives of Teams -Types of Teams- Team Building-Creating Effective teams-**Group Dynamics:** Definition of Group- Formal Vs Informal Groups- Stages of Group Development- Johari Window- Transactional Analysis- Conflict -Definition, Conflict Resolution Mechanisms in Groups	**CO4**
V	**Organizational Change and Culture: Organizational Change-** Definition- Change Models- Organizational resistance to change Management of Change Process- Organizational Culture- Definition- Objectives-Distinction between Organizational Culture and Organisational Climate	**CO5**

Learning Resources

Text Books

1. Fred Luthans, Organizational Behaviour, McGraw Hill, 11th Edition, 2001.
2. Stephen P. Robins, Organisational Behaviour, PHI Learning / Pearson Education, 11th edition, 2008.

Reference Books

1. Hellrigal, Slocum and Woodman, Organizational Behaviour, Cengage Learning, 11th Edition 2007.
2. Aswathappa K., "Organizational Behaviour-Text, Cases and Games", Himalaya Publishing House, New Delhi, 2008.
3. Schermerhorn, Hunt and Osborn, Organizational Behaviour, John Wiley, 9th Edition, 2008.
4. Udai Pareek, Understanding Organizational Behaviour, 2nd Edition, Oxford Higher Education, 2004.
5. Ivancevich, Konopaske &Maheson, Organizational Behaviour & Management, 7th edition, Tata McGraw Hill, 2008.
6. Hitt, Michael .A., Organizational Behaviour- A Strategic Approach, Wiley, India,2008.

PVP 19

COMMUNICATION NETWORKS

Course Code	19EC3701	**Year**	IV	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Identify the components required to build various networks. (L2)
CO2	Choose the required functionality at each layer for a given application (L3)
CO3	Trace & detect errors in the flow of information in a network (L4)
CO4	Build the skills of sub netting and routing mechanisms (L3)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2	2	2							1	2	1
CO2	2	3	2	2	2							1	2	1
CO3	2		2	2	2							1	2	1
CO4	3	3	3	2	3							1	2	1
Average* (Rounded to nearest integer)	3	3	3	2	3							1	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Computer Networks and the Internet: Services description and definition of protocol, Network Edge and Network Core. Delay, Loss, and Throughput in Packet-Switched Networks, Protocols layers and their service models.	CO1
II	Application Layer: Principles of Network Applications, The Web and the HTTP, Electronic Mail, Domain Naming Systems, Socket Programming.	CO2
III	Transport Layer: Introduction to transport layer services, multiplexing and demultiplexing, connectionless transport: UDP, principles of reliable data transfer, connection-oriented transport: TCP	CO1, CO3
IV	Network Layer (Data Plane): Overview of network layer, Internals of a Router, Internet Protocol: IPv4, Addressing, IPv6. Network Layer (Control Plane): Routing algorithms, IntraAS routing (OSPF), Routing among ISPs (BGP), Internet control message protocol (ICMP).	CO1, CO4

V	Link Layer and LANs: Introduction to the link layer, error detection and correction techniques, multiple access links and protocols, switched local area networks. Wireless links and network characteristics, 802.11 Wireless LANs, Cellular Internet Access.	CO1,CO3, CO4

Learning Resources
Text Books
1. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", 5/e, Pearson Education, 2017.
Reference Books
1. L. Peterson and B. Davie, "Computer Networks – A Systems Approach", 5/e, Elsevier India, 2011. 2. A. Forouzan, "Data Communications and Networking", 4/e, Tata McGraw Hill, 2013. 3. Andrew Tanenbaum, "Computer networks", 7/e, Prentice Hall, 2015 4. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall of India, 2007. 5. William Stallings, "Data and computer communications", 4/e, Prentice Hall of India, 2010.
e- Resources & other digital material
1. http://home.iitk.ac.in/~navi/sidbinetworkcourse/lecture1.ppt 2. http://nptel.iitm.ac.in/courses/IIT-MADRAS/Computer_Networks/index.php

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PVP 19

SATELLITE COMMUNICATIONS

Course Code	19EC4701A	**Year**	IV	**Semester**	I
Course Category	Program Elective IV	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Analog and Digital communications
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Demonstrate an understanding on orbital and functional principles of satellite Communication and Satellite sub system (L2)
CO2	Interpret and select appropriate technologies for implementation of specified Satellite communication systems (L5)
CO3	Analyse a satellite link and suggest enhancements to improve the link Performance (L4)
CO4	Choose appropriate multiple access technique for a given satellite communication application (L3)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)
Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation
* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	-	-	-	2	2	-	-	-	-	2	-	-
CO2	1	3	-	-	-	2	2	-	-	-	-	2	-	-
CO3	2	3	2	-	-	1	1	-	-	-	-	1	-	2
CO4	1	2	2	-	-	2	2	-	-	-	-	2	-	2
Average* (Rounded to nearest integer)	2	3	2			2	2					2		2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**INTRODUCTION:** Introduction, Frequency allocation to satellite services, INTELSAT	CO1
II	**ORBITAL MECHANICS AND LAUNCHERS:** Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.	CO1, CO2
III	**SATELLITE SUBSYSTEMS:** Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.	CO1, CO2

IV	**SATELLITE LINK DESIGN**: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.	CO1, CO3
V	**MULTIPLE ACCESS:** Frequency division multiple access (FDMA). Time division Multiple Access (TDMA), TDMA Frame Structure, Transmitter Power in TDMA Networks, Satellite Switched TDMA, Onboard Processing, Baseband Processing Transponders, Satellite Switched TDMA with Onboard Processing, Demand Access Multiple Access (DAMA), Code Division Multiple access (CDMA).	CO1, CO4

Learning Resources
Text Books
1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003. 2. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996**.**
Reference Books
1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003. 2. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed. 3. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004
e- Resources & other digital material
1. https://nptel.ac.in/courses/117/105/117105131/3.https://nptel.ac.in/courses/108/105/108105159/

PVP 19

DIGITAL SIGNAL COMPRESSION

Course Code	19EC4701B	**Year**	IV	**Semester**	I
Course Category	Program Elective IV	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Digital Signal Processing
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyse various coding techniques used for signal compression (L4)
CO2	Calculate rate distortion for different sources (L2).
CO3	Compare different quantization techniques used for compression (L4)
CO4	Examine the compression standards of audio, image and video signals. (L2).
CO5	Apply various signal compression techniques and evaluate their performance (L3).

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	2							1	2	1
CO2	3	3	2	2	2							1	2	1
CO3	3	3	2	2	2							1	2	1
CO4	3	3	2	2	2							1	2	1
CO5	3	3	2	2	2							1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2							1	2	1

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**Mathematical Preliminaries for Lossless Compression:** Overview, a brief introduction to information theory, derivation of average information, models, coding. **Huffman Coding:** Overview, the Huffman coding algorithm. **Arithmetic Coding:** Introduction, coding a sequence, generating a binary code,comparison of Huffman and Arithmetic coding, Adaptive Arithmetic coding.	**CO1**
II	**Mathematical Preliminaries for Lossy Coding:** Introduction, distortion criteria, information theory revisited models. **Scalar Quantization:** Introduction, the quantization problem, uniform quantizer, adaptive quantization, non-uniform quantization.	**CO2, CO3**

III	**Vector Quantization:** Introduction, advantages of vector quantization over scalar quantization, the Linde-Buzo-Gray algorithm. **Differential Encoding:** Introduction, the basic algorithm, prediction in DPCM,Adaptive DPCM, delta modulation, speech coding.	**CO3**
IV	**Transform Coding:** Transforms of interest, quantization and coding of transform coefficients, application to image compression—JPEG, application to audio compression-the MDCT. **Subband Coding:** Introduction, filters, some filters used in subband coding, the basic subband coding algorithm.	**CO3, CO4**
V	**Audio Coding:** Introduction, MPEG audio coding. **Video compression:** Introduction, motion compensation, video signal representation, ITU-T recommendation H.261.	**CO5**

Learning Resources
Text Books
1. Khalid Sayood, Introduction to Data Compression, 4/e, Elsevier, India, 2012.
Reference Books
1. Jayant, Noll, Digital Coding of Waveforms-Principles and Applications to Speech and Video Prentice Hall, New York, 1984. 2. David Salomon, Data Compression: The Complete Reference, Springer, 2000. 3. ZiNian Li, Fundamentals of Multimedia, Pearson Education, 2003.
e- Resources & other digital material
1. http://www.nptel.iitm.ac.in/

PVP 19

DIGITAL INTEGRATED CIRCUITS DESIGN

Course Code	19EC4701C	**Year**	IV	**Semester**	I
Course Category	Program Elective-IV	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Digital Logic Design
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Design CMOS inverters (L5)
CO2	Analyze different scaling methods for MOS logical circuits (L4)
CO3	Implement different techniques to improve Area, power and speed of MOS logical circuits (L3).
CO4	Analyze timing issues and arithmetic building blocks . (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3		3		3					3			3	
CO2	3		3		3					3			3	
CO3	3	3								3			3	
CO4	3	3								3			3	
Average* (Rounded to nearest integer)	3	3	3	3	3					3			3	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**CMOS INVERTER:** Introduction, The static CMOS inverter, Evaluating the robustness of CMOS inverter, Performance of CMOS inverter, Dynamic behaviour of CMOS inverter, and Power delay product	CO-1
II	Technology scaling in VLSI, Full Scaling , Constant Voltage scaling , combined(mixed) scaling methods ,scaling factors for MOS circuits: Logic gate Area, gate capacitance, carrier density,, channel resistance, gate delay, maximum operating frequency, saturation current, current density, power dissipation and power –delay product.	CO-2
III	**DESIGNING COMBINATIONAL LOGIC GATES IN CMOS:** Ratioed Logic , Pass transistor Logic, Static CMOS design, Dynamic Domino CMOS logic design, performance of Dynamic logic, switching activity of logic gate, short circuit currents in CMOS logic gates, Power Consumption in CMOS Gates, Designing BICMOS logic gates	CO-3

IV	**TIMING ISSUES IN DIGITAL CIRCUITS**: Introduction, Timing classification of digital systems, Synchronous design, Clock Skew and Clock Generation. Synchronization at the system level, synchronous verses asynchronous design	CO-4
V	**DESIGNING ARITHMETIC BUILDING BLOCKS**: Data paths in Digital processor architectures, carry select adder, Carry Skip Adder ,Carry Look Ahead Adder , Carry Save Adder , multiplier, shifter, Power and speed trade-offs in data path structures	CO-4

Learning Resources
Text Books
1. Digital Integrated Circuits- Jan M Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Second Edition, PHI.
Reference Books
1. CMOS VLSI Design- Neil H.E.Weste, David Money Harris, Fourth Edition

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PVP 19

MICROWAVE ANTENNAS

Course Code	19EC4701D	**Year**	IV	**Semester**	I
Course Category	Program Elective IV	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Infer microwaves and radio waves and identify the applications of microwaves (L2).
CO2	Explain different types of antennas designed for microwave frequency ranges (L2).
CO3	Develop Microwave antennas for various applications(L3)
CO4	Take part in the measurement of antenna parameters in the laboratory.(L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2									3	
CO2	3	3	3	3									3	
CO3	3	3	3	3	3								3	
CO4	3	3	3	3	3				2	2			3	
Average* (Rounded to nearest integer)	3	3	3	3	3				2	2			3	

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to microwave antennas:** Introduction, Microwave frequency bands, Applications of microwave antennas and advantages of microwaves. **Broadband antennas**: Biconical antenna, bow-tie and cylindrical dipole.	CO1 , CO2, CO3
II	Frequency independent antennas, antenna miniaturization: Introduction, theory, equiangular spiral antennas, log-periodic antennas, Aperture antennas-Rectangular apertures, circular apertures, Horn antennas-E-Plane, H-Plane, Pyramidal and conical horn antennas and lens antennas-Introduction ,Geometry of Non-metallic Dielectric lenses. Zoning, Applications.	CO1 , CO2, CO3
III	**Reflector antennas**: Introduction, Flat Sheet and Corner Reflectors, Paraboloid Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types	CO1 , CO2, CO3

IV	**Micro strip antennas:** Introduction**,** Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Micro strip Antennas. Rectangular patch, circular patch antennas-Geometry and parameters	CO1 , CO2, CO3
V	**Antenna Measurements:** Introduction, Antenna ranges, radiation patterns, gain measurements, directivity measurements, radiation efficiency, impedance measurements, current and polarization measurements.	CO4

Learning Resources
Text Books
1. Contantine A. Balanis, Antenna Analysis and Design, 3/e, Wiley Publications, 2009. 2. A.R. Harish, M. Sachidananda, Antennas and Wave Propagation, 1/e, Oxford University Press, 2007.
Reference Books
1. E. C. Jordan and K. G. Balmain, Electromagnetic Waves and Radiation Systems, Prentice Hall of India, 2012 2. Rajeswari Chatterjee, Antenna Theory and Practice, 2/e, New Age International Publishers, 2004. 3. F. E. Terman, Electronic and Radio Engineering, McGraw Hill, 1947

PVP 19

IOT ARCHITECTURE

Course Code	19EC4701E	**Year**	IV	**Semester**	I
Course Category	Program Elective IV	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		BT Level
Upon successful completion of the course, the student will be able to		
CO1	**Describe** the programmer's model.	**L2**
CO2	**Choose** the appropriate protocol for communication between IoT	**L3**
CO3	**Analysis and evaluate** the data received through sensors in IOT.	**L4**
CO4	**Determine** the right sensors and communication protocols to use in a particular IoT system.	**L5**

Mapping of course outcomes with Program outcomes (CO/PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3									2	2
CO2	3	3	3	3									2	2
CO3	3	3	3	3									2	2
CO4	3	3	3	3									2	2
Average* (Rounded to nearest integer)	3	3	3	3									2	2

Syllabus

Unit No.	Contents	Mapped CO
I	**Internet of Things:** An Overview, Internet of Things, IoT conceptual framework, IoT architectural view, Technology behind IoT, Sources of IoT, M2M communication, Examples of IoT.	CO1
II	**Design Principles for Connected Devices:** Introduction, IoT/M2M systems layers and designs standardisation, Communication technologies, Data enrichment, Data consolidation and device management at gateway, Ease of Designing and Affordability.	CO2
III	Web communication protocols for connected devices, Message communication protocols for connected devices, web connectivity for connected-devices network using gateway, Internet connectivity principles, IP addressing in IoT, Proxy authentication, Media Access control, Application Layer Protocols.	CO2
IV	Data acquiring and storage, Organizing the data, Analytics, Knowledge acquiring, managing and storing processes, cloud computing paradigm for data collection storage and computing, IoT cloud based services.	CO3
V	Sensor technology (Analog sensors and Digital sensors), Actuator, Sensor data communication protocols, Radio frequency identification technology, wireless sensor networks, Introduction to Arduino, Arduino IDE, Node MCU, Introduction to Raspberry Pi. IoT case study: Smart city street lights control and monitoring.	CO4

Learning Resources
Text Books
1. Raj kamal, “Internet of Things architecture and design principles “, 1ed, Mc Graw Hill.

PVP 19

SENSORS AND TRANSDUCERS FOR REMOTE APPLICATIONS

Course Code	19EC4701F	**Year**	IV	**Semester**	I
Course Category	Programme Elective-IV	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the basic concepts and characteristics of Sensors (L2)
CO2	Discuss the construction, working principle, characteristics and applications of various resistive Sensors.(L4)
CO3	Discuss the construction, working principle, characteristics and applications of various Capacitive Sensors.(L4)
CO4	Discuss the construction, working principle, characteristics and applications of Self-Generating Sensors.(L4)
CO5	Understands the basic concepts of telemetry systems (L2)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2			1	1	1		1	2	1
CO2	3	3	2	2	2			1	1	1		1	2	1
CO3	3	3	2	2	2			1	1	1		1	2	1
CO4	3	3	2	2	2			1	1	1		1	2	1
CO5	3	3	2	2	2			1	1	1		1	2	1
Average* (Rounded to nearest integer)	3	3	2	2	2			1	1	1		1	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Introduction to Sensors based measurement systems- General Concepts and Terminology, Sensor Classification-sensors, General input-output Configuration, Static characteristics of measurement system, Dynamic Characteristics, Other sensor characteristics.	CO1
II	Resistive Sensors - Potentiometers, Strain Gages, Resistive Temperature Detectors (RTD), Thermistors, Magneto resistors, Light-Dependent Resistors (LDR), Resistive Hygrometers, Resistive Gas Sensors.	CO2

III	Capacitive Sensors - Variable capacitor, Differential capacitor. Inductive sensors - Variable reluctance sensors, Eddy current sensors, Linear variable differential transformers (LVDT), variable transformers, Magneto elastic and magnetostrictive sensors.	CO3
IV	Self-Generating Sensors- Thermoelectric Sensors, Piezoelectric Sensors, Pyroelectric Sensors, Photovoltaic sensors, Electrochemical Sensors.	CO4
V	Introduction to Telemetry principles, Basic System, Classification, Non-electrical Telemetry system, Voltage and Current Telemetry System, Local transmitters and convertors, frequency telemetering, Satellite Telemetry, Fibre optic telemetry	CO5

Learning Resources

Text Books

1. Ramon Pallas-Areny, Jhon G. Webster, "Sensors and Signal Conditioning" -2nd Edition, John Wiley and Sons
2. D Patrabnis, "Telemerty Principles", Tata McGraw Hill, 2007.

Reference Books

1. A.K. Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai.
2. Er. R.K. Rajput, "Electronic Measurements and Instrumentation", S. Chand & Company Ltd. 3rd Edition.
3. Bentley, John P., "Principles of Measurement Systems", 4thedition, Pearson/Prentice Hall, 2005.
4. Jon. S. Wilson, "Sensor Technology Hand Book", Elsevier Inc., 2005.

GLOBAL POSITIONING SYSTEMS

Course Code	19EC4702A	Year	IV	Semester	I
Course Category	Program Elective V	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Satellite communication
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand GPS signals and their characteristics (L2).
CO2	Classify and discuss about GPS receivers (L2)
CO3	Demonstrate different types of GPS **errors** (L3)
CO4	Analyse various standard formats of GPS(L3)
CO5	Differentiate GPS applications (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1		1	1	1	1	1	2
CO2	3	2	1	1	1	1	1		1	1	1	1	1	2
CO3	3	3	2	1	2	1	1		1	1	1	1	1	2
CO4	3	3	3	2	2	1	1		1	1	1	1	1	2
CO5	3	3	3	2	2	1	1		1	1	1	1	1	2
Average* (Rounded to nearest integer)	3	3	2	2	2	1	1		1	1	1	1	1	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to GPS:** Overview of GPS, GPS segments, GPS satellite generations, current GPS satellite **constellation, control sites.**	CO1, CO2 & CO3
II	**GPS Details:** GPS signal structure, GPS modernization, types of GPS receivers, time systems, pseudo range measurements, Carrier-phase measurements and cycle slips.	CO1, CO2 &CO3
III	**GPS errors and Biases:** GPS ephemeris errors, Selective availability, satellite receiver and clock error, multipath error, ionospheric error, tropospheric error	CO1, CO2 &CO3
IV	**GPS standard formats:** RINEX, NGS-SP3, RTCM SC-104 and NMEA 0183.	CO1, CO3& CO4

V	**GPS Applications:** GPS for utilities industry, forestry and natural resources, precision farming, civil engineering applications, monitoring structural deformations, open pit-mining, land seismic surveying, marine seismic surveying, airborne mapping, sea floor mapping and vehicle navigation.	CO1,CO4& CO5

Learning Resources
Text Books
1. Introduction to GPS the global positioning system: by Ahmed EI-Rabbany, Artech House Boston. London.
Reference Books
1. Fundamentals of Global Positioning System Receivers: A Software Approach, James Bao-Yen Tsui Copyright @ 2000 John Wiley & Sons, Inc.

PVP 19

BIOMEDICAL SIGNAL PROCESSING

Course Code	19EC4702B	**Year**	IV	**Semester**	I
Course Category	Program Elective-V	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyse ECG, EEG, EMG and PCG waveforms by applying signal processing, reduction and filtering techniques (L4).
CO2	Analyse ECG, EEG, EMG and PCG signals using data acquisition, Data Reduction methods (L4).
CO3	Determine the disorders related to Neurological Advanced Signal processing techniques & Modelling of Biomedical Systems by using advanced signal processing techniques (L5).
CO4	Evaluate the medical signals by using advanced techniques (L5).
CO5	Analyse the various data compression methods (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2		3					2		2	3
CO2	3	3	3	2		3					2		2	3
CO3	3	3	3	2		3					2		2	3
CO4	3	3	3	2		3					2		2	3
CO5	3	3	3	2		3					2		2	3
Average* (Rounded to nearest integer)	3	3	3	2		3					2		2	3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Biomedical signals:** Bio-signal Characteristics of Electro Cardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Phonocardiogram (PCG), Objectives of Biomedical signal analysis, Difficulties in Biomedical signal analysis, Computer-aided diagnosis	CO1 ,CO4
II	**ECG Signal Processing:** ECG data acquisition, ECG lead system, ECG parameters and their estimation, ECG QRS detection techniques: Template matching, differentiation based QRS detection techniques. Estimation of R-R Interval: Finite first difference method. The use of multi-scale analysis for parameter estimation of ECG waveforms, Arrhythmia analysis monitoring, long term continuous ECG recording	CO1,CO2, CO4

III	**ECG Data Reduction Techniques***:* Direct data compression techniques, direct ECG data compression techniques: Turing point algorithm, AZTEC algorithm and FAN algorithm, other data compression techniques: data compression by DPCM, data compression method comparison.	CO1,CO2, CO4,CO5
IV	**Neurological applications:** EEG rhythms & waveforms, EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models - Nonlinear modeling of EEG - artifacts in EEG & their characteristics and processing – Nonparametric spectral analysis, Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis - correlation analysis of EEG channels -coherence analysis of EEG channels. Evoked potentials- noise characteristics, Noise reduction by linear filtering.	CO1,CO3, CO4
V	**Advanced Signal processing techniques & Modeling of Biomedical Systems:** Optimal Signal Processing: Wiener Filters, Adaptive Signal Processing, Adaptive Noise Cancellation. Parametric system modeling, Autoregressive or All-Pole modeling, Pole-Zero Modeling.	CO1,CO3, CO4

Learning Resources
Text Books
1. Rangaraj M Rangayyan ,"Biomedical Signal Analysis" –, IEEE Press, 2001 2. Biomedical Digital Signal Processing – Willis J Tomkins, PHI, 1993
Reference Books
1. Biomedical Digital Signal Processing Principles and Techniques-D C Reddy, TMH, 2005
e- Resources & other digital material
1. http://www.biomedicahelp.altervista.org › Segnali 2.https://www.digimat.in/nptel/courses/video/108105101/L12.html

PVP 19

ANALOG IC DESIGN

Course Code	19EC4702C	**Year**	IV	**Semester**	I
Course Category	Program Elective V	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	VLSI Design
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Contrast MOS devices, its models and differential amplifiers.	L4
CO2	Build single stage and differential amplifiers using MOSFET	L3
CO3	Analyze OP-AMP based Circuits.	L4
CO4	Learn layout and packaging processes	L2

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1:Low)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1								2	1
CO2	3	2	2	2	1								2	1
CO3	3	2	2	2	1								2	1
CO4	3	2	2	2	1								2	1
Average* (Rounded to nearest integer)														

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Basic MOS Device Physics:** General Considerations, MOS I/V Characteristics, Second-Order Effects, MOS Device Models.	CO1, CO2
II	**Single Stage and Differential Amplifiers:** Common-Source Stage, Source Follower, Common- Gate Stage, Cascode Stage, Basic Differential Pair, Common-Mode Response, Differential Pair with MOS Loads.	CO1, CO2
III	**Operational Amplifiers:** General Considerations, One-Stage Op Amps, Two-Stage Op Amps, Gain Boosting, Common-Mode Feedback, Input Range Limitations, High-Slew-Rate Op Amps, Power Supply Rejection.	CO3
IV	**Nanometer Design Studies:** Transistor Design Considerations, Deep-Submicron Effects, Transconductance Scaling, Transistor Design, Op Amp Design Examples, High-Speed Amplifier.	CO3
V	**Layout and Packaging:** General Layout Considerations, Analog Layout Techniques, Substrate Coupling, Packaging.	CO4

Learning Resources
Text Books
1. Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2/e, Mc-Graw Hill Education, 2017
Reference Books
1. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, 7/e, Oxford University Press. 2. R. Jacob Baker, CMOS Circuit Design, Layout and Simulations, 3/e, IEEE press, 2010. 3. David A. Johns, Ken Martin, Analog Integrated Circuit Design, 2/e, John Wiley & Sons. 4. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, 10/e,Pearson Education, 2009.

PVP 19

RADAR SYSTEMS

Course Code	19EC4702D	**Year**	IV	**Semester**	I
Course Category	Program Elective - V	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	AC, AAS
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret the complete radar range equation and statistical parameters of Noise L2
CO2	Analyse the fixed and moving targets using different types of radar systems. L4
CO3	Identify various tracking methods, different types of display devices & duplexers. L3
CO4	Apply the various techniques in radar receivers for detection of signals in noise. L3

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	1							1	2
CO2	3	1	2							1	2
CO3	3	3	2							1	2
CO4	3	3	2							1	2
Average* (Rounded to nearest integer)	3	3	2							1	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Nature of Radar**: Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses	CO1
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 (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.	CO2
III	**MTI and Pulse Doppler Radar:** Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters, Non-coherentMTI, MTI versus Pulse Doppler Radar.	**CO2**

IV	**Tracking Radar:** Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one and two coordinates), Phase Comparison Monopulse. Comparison of Trackers.	**CO3**
V	**Detection of Radar Signals in Noise :** Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters Matched Filter with Non-white Noise. Radar Receivers – Noise Figure and Noise Temperature. Displays – types. Duplexers – Branch type and Balanced type.	**CO4 & CO5**

Learning Resources
Text Books
1. Introduction to Radar Systems – Merrill I. Skolnik, 2nd Edition, McGraw-Hill. 2. Microwave and Radar Engineering – Gottapu Sasi Bhushana Rao
Reference Books
1. Introduction to Radar Systems – Merrill I. Skolnik, 3rd Edition, Tata McGraw- Hill, 2. Understanding Radar Systems – Simon kingsley, McGraw-Hill,1st edition., 1992 3. Radar Principles- Peyton Z. Peebles, Jr., Wiley India Pvt. Ltd., 2009
e- Resources & other digital material
1. https://deebak.files.wordpress.com/2009/05/skolnik.pdf

PVP 19

TV TECHNOLOGY

Course Code	19EC4702E	**Year**	IV	**Semester**	I
Course Category	Program Elective V	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Analog and Digital Communications
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Compare Digital TV transmission standards and performance parameters (L2)
CO2	Analyse channel coding and modulation techniques for Digital TV (L4)
CO3	Make use of RF amplifiers, modules and systems for Digital TV (L3)
CO4	Identify Transmission lines for Digital TV(L3)
CO5	Test for a Digital TV Transmitter (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	2	-	-	1	2	-	-	-	-	2	-	2
CO2	2	2	2	-	-	-	-	-	-	-	-	2	-	-
CO3	-	2	2	-	-	-	-	-	-	-	-	-	-	2
CO4	-	-	2	-	-	2	-	-	-	-	-	2	-	3
CO5	-	2	-	-	-	-	1	-	-	-	-	2	-	2
Average* (Rounded to nearest integer)	2	2	2			2	2					2		3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Digital Television Transmission Standards ATSC terrestrial transmission standard, vestigial sideband modulation, DVB-T transmission standard, ISDB-T transmission standard, channel allocations, antenna height and power, MPEG-2 Performance Objectives for Digital Television: System noise, external noise sources, transmission errors, error vector magnitude, eye pattern, interference, cochannel interference, adjacent channel interference, analog to digital TV, transmitter requirements	CO1
II	Channel Coding and Modulation for Digital Television: Data synchronization, randomization/scrambling, forward error correction, interleaving, inner code, frame sync insertion, quadrature modulation, 8 VSB, bandwidth, error rate, COFDM, flexibility, bandwidth	CO1, CO2
III	**Transmitters for Digital Television**: Precorrection and equalization, up conversion, precise frequency control, RF amplifiers, solid-state transmitters, RF amplifier modules, power supplies, cooling, automatic	CO1,CO3

	gain or level control, ac distribution, transmitter control, tube transmitters, performance quality.	
IV	**Transmission Line for Digital Television:** Fundamental parameters, efficiency, effect of VSWR, system AERP, rigid coaxial transmission lines, dissipation, attenuation, and power handling, higher-order modes, peak power rating, frequency response, standard lengths, corrugated coaxial cables, wind load, waveguide, bandwidth, waveguide attenuation, power rating, frequency response, size trade-offs, waveguide or coax pressurization	CO1,CO4
V	**Test and Measurement for Digital Television:** Power measurements, average power measurement, calorimetry, power meters, peak power measurement, measurement uncertainty, testing digital television transmitters.	CO1,CO5

Learning Resources
Text Books
1. Gerald w. Collins, Fundamentals of Digital Television Transmission, John Wiley, 2001.
Reference Books
1 R. R. Gulati, Modern Television Practice, Principles, Technology and servicing, 2/e, New Age International Publishers, 2001. 2 John Arnold, Michael Frater, Mark Pickering, Digital Television Technology and Standards, John Wiley, 2007.
e- Resources & other digital material
1.https://www.youtube.com/watch?v=_nGnRvyHMEI&list=RDCMUCdlnqMpRrMcClK2fT6z8EEw&index=2 2. https://www.rfwireless-world.com/Tutorials/digital-television-DTV-basics.html

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PVP 19

IOT IN HEALTH CARE

Course Code	19EC4702F	**Year**	IV	**Semester**	I
Course Category	Program Elective V	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Demonstrate the sensing principles, technologies and security issues involved in Biomedical Telemetry(L2)
CO2	Identify the sensing technologies for biomedical telemetry(L3)
CO3	Identify various security issues involved in biomedical telemetry(L3)
CO4	Analyze the role of IOT in biomedical applications(L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3						3	3
CO2	3	3	3	3	3	3	3						3	3
CO3	3	3	3	3	3	3	3						3	3
CO4	3	3	3	3	3	3	3						3	3
Average* (Rounded to nearest integer)	3	3	3	3	3	3	3						3	3

Syllabus

Unit No.	Contents	Mapped CO
I	Introduction to Biomedical Telemetry. Typical Biomedical Telemetry System, Challenges in Biomedical Telemetry, Commercial Medical Telemetry Devices	CO1
II	Sensing Principles for Biomedical Telemetry, Introduction, Biosensor Structure, Electrochemical Biosensors, Amperometric Electrochemical Biosensors, Optical Biosensors, Thermal/Calorimetric Biosensors, Piezoelectric Biosensors, Other Types of Biosensors	CO1, CO2
III	Sensing Technologies for Biomedical Telemetry, Introduction, Non-invasive Sensors and Interfaces, Invasive and Implantable Sensors	CO1, CO2
IV	Safety Issues in Biomedical Telemetry, Introduction, Operational Safety, Product and Device Hazards, Patient and Clinical Safety, Human Factor and Use Issues, Electromagnetic Compatibility and Interference Issues, Occupational Safety	CO1, CO3

V	IoT in Biomedical Applications IoT client &IoT gateway in healthcare, IoT driven smart health care application for everyday use, life critical applications, Health care IOT for rural area, Use of Big Data and Visualization in IoT, Industry 4.0 concepts, sensor markup language	CO4

Learning Resources
Text Books
1.K S Nikitha, "Handbook of Biotelemetry", Wiley publishers, 2014 2. Samuel Greengard, "The Internet of Things", MIT Press, 1stEdition, 2015
Reference Books
1. D Patranabis, "Telemetry Principles", Tata McGraw Hills, 2007 2. Catarina I Reis and Maria D S Maximiano, "Internet of Things and Advanced Applications in Healthcare", IGI-Global, 2017.

PVP 19

RENEWABLE ENERGY RESOURCES

Course Code	19EE2701A	**Year**	IV	**Semester**	I
Course Category	IDE-2	**Branch**	Common to all	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	--
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand the basics of solar energy, wind energy, bio mass, geothermal energy, Ocean energy and principles of energy conversion. (L2)
CO2	Explain and classify instruments for measuring solar radiation solar collectors, solar energy storages, wind turbines, geothermal, MHD and fuel cell. (L2
CO3	Analyze different types of solar collectors, solar cell, combustion characteristics of biogas, thermodynamic cycles, operating conditions of fuel cell (L4)
CO4	Outline about solar radiation, power from solar module, performance characteristics of wind mill, potential and conversion techniques of tidal and wave energy, mini-hydel power plants and their economics. (L2)

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3			2	2	1			2	2	3
CO2	3	3		1		3	3	2	1			1	3	2
CO3	3	3		3			2					1	2	2
CO4	3	2		1			1					1	3	3
Average* (Rounded to nearest integer)	3	3		2		3	2	2	1			2	3	3

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	Principles of Solar Radiation and Solar Energy Collection Role and potential of new and renewable source, the solar energy option, environmental impact of solar power, physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors	CO 1 CO 2 CO 3 CO 4
II	Solar Energy Storage, Applications and Photovoltaic Energy Conversion Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications solar heating/cooling technique, solar distillation and drying. Solar cell fundamentals, solar cell classification, performance of solar cell- power from solar module.	CO 1 CO 2 CO 3 CO 4

III	Wind Energy and Bio-Mass Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria. Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of bio-gas digesters, gasyield, combustion characteristics of bio-gas, utilization for cooking	**CO 1 CO 2 CO 3 CO 4**
IV	Geothermal Energy and Ocean Energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.	**CO 1 CO 2 CO 3 CO 4**
V	Energy Conversion Principles of energy conversion, MHD generators, principles, MHD power generation systems. Fuel cells, principles, of fuels and operating conditions, merits and demerits of different types of fuel cells, mini-hydel power plants and their economics.	**CO 1 CO 2 CO 3 CO 4**

Learning Resources

Text books

1. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition, 2014.
2. Renewable Energy Sources and Emerging Technologies by D.P Kothari, K.C Singal, Rakesh Ranjan , PHI learning Pvt Ltd, 2nd edition ,2012

References

1. Renewable Energy resources by Tiwari and Ghosal, publisher Narosa, 2005
2. Renewable Energy Resources by John Twidell and Tony Weir , publisher Taylor and Francis, 2nd edition 2006
3. Solar Photo Voltaics Fundamentals, Technology and application by Chetan Singh Solanki, publisher PHI learning Pvt Ltd, 3rd edition,2019
4. Wind Energy Theory and Practice by Siraj Ahmed publisher PHI learning Pvt Ltd ,3rd edition, 2016

PVP 19

WEB TECHNOLOGIES

Course Code	19IT2701A	**Year**	IV	**Semester**	I
Course Category	IDE-2	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	JAVA
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		**Blooms Taxonomy Level**
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic concepts of HTML,CSS,XML,JDBC connectivity, Servlets and JSP	**L2**
CO2	use Java script for validation of web pages	**L3**
CO3	Analyze the concepts of DOM,JDBC Architecture and life cycles of Servlets and JSP	**L4**
CO4	Compare the concepts of HTML and XML, Servlets and JSP	**L4**
CO5	Develop simple web applications using JDBC, servelet and JSP	**L6**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2		2								2	2
CO2			2		2								2	2
CO3			2		2									
CO4			2		2									
CO5			2	2	2									
Average* (Rounded to nearest integer)			2	2	2								2	2

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to web technologies:** History of the web, Overview of HTTP, HTML Introducing HTML document structure, Creating Headings, links, paragraph, images, tables, frames, forms and html controls on a web page	CO1
II	**Introducing cascading style sheets:** Inline, External, Internal, Style class, Multiple styles, Introducing JavaScript , Using Variables, Using Operators, Working with Control Flow statements, Working with functions, Handling Events, Using Arrays, Creating objects in Java Script	CO2
III	**Working with XML:** Introduction to XML, XML Basics, XML Technologies, Extensible HTML (XHTML), Java API for XML Processing, Document Object Model (DOM)	CO1, CO3

IV	**Working with database:** Getting started with JDBC, Defining ODBC, Introduction to JDBC, Components of JDBC, JDBC Architecture, Types of Drivers, Working with JDBC APIs, Creating a Simple Application, Working with Prepared Statement, Using Callable Statement	CO1, CO3, CO4, CO5
V	**Working with servlets:** Introducing the MVC architecture, Describing Servlets, Understanding Servlets, What are servlets, introducing the Servlet API, Servlet Life Cycle, Developing First Servlet Application **Working with JSP:** Introduction to JSP, Understanding JSP, Describing the JSP Life Cycle, Creating a Simple JSP pages	CO1, CO3, CO4, CO5,

Learning Resources
Text books
1. Web Technologies, Black Book, Kogent Learning Solutions Inc, Dreamtech Press. 2. JDBC, Servlets, and JSP, New Edition, Santhosh Kumar K, Kogent Learning Solutions Inc, Dreamtech Press.
References
1. Web Technologies, Uttam K. Roy, Volume 2 , Oxford University 2. Core Servlets and Java Server Pages Volume 1 CORE TECHNOLOGIES , Marty Hall and Larry Brown Pearson 3. Internet and World Wide Web – How to program, Dietel and Nieto 4. An Introduction to Web Design and Programming –Wang-Thomson 5. Professional Java Server Programming S.Allam Raju and others Apres (dreamtech) 6. Java Server Programming, Ivan Bayross and others, The X Team, SPD 7. Beginning Web Programming-Jon Duckett WROX. 8. Java Server Pages, Pekowsky, Pearson. 9. Java Script, D.Flanagan, O‟Reilly, SPD.
e-Resources and other Digital Material
1. http://nptel.ac.in/courses/106105084/13 2. http://www.w3schools.com/ 3. https://www.javatpoint.com/html-tutorial

PVP 19

OPTIMIZATION TECHNIQUES

Course Code	19ME2701B	**Year**	IV	**Semester**	I
Course Category	IDE-2	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Operations Research
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply various Classical optimization techniques	L3
CO2	Select suitable Numerical method for optimization of Engineering Problems.	L4
CO3	Analyze multi stage decision making process through dynamic programming	L4
CO4	Enumerate fundamentals of Integer programming technique	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2		2		2		2		2	2	2
CO2	2	3	3	2		2		2		2		2	2	2
CO3	2	3	3	2		2		2		2		2	2	2
CO4	2	2	3	2		2		2		2		2	2	2
Average* (Rounded to nearest integer)	2	3	3	2		2		2		2		2	2	2

Syllabus

Unit No	**Contents**	**Mapped CO**
Unit-I	**Introduction to optimization**: Introduction, engineering applications of optimization, statement of an optimization problem-design vector, design constraints, constraint surface, objective function, classification of optimization problems, optimization techniques. **Classical Optimization techniques:** Introduction, single variable optimization, multi variable optimization with no constraints, multi variable optimization with equality constraints-Lagrange multiplier method.	CO1
Unit-II	**Non-linear programming, I**: One Dimensional Minimization Methods: Introduction, unimodal function, elimination methods-unrestricted search, exhaustive search, interval halving method, Fibonacci method, golden section method, interpolation method,	CO2
Unit-III	**Non-linear programming II:** Direct Search Method- Nelder- Mead Simplex method, Indirect search methods- steepest descent method (Cauchy's method), Newton Method, Marquardt Method	CO2
Unit-IV	**Dynamic Programming:** Multistage decision processes, Concepts of sub optimization- calculus method and tabular methods, Linear programming as a case of D.P	CO3

Unit-V	**Integer Programming**: Introduction, Graphical Representation, Gomory's cutting plane method, Balas algorithm for zero-one programming, Branch-and- bound method, Penalty Function method; Basic approaches of Interior and Exterior penalty function methods.	CO4

Learning Resource
Text books:
1. S.S.Rao, Engineering optimization theory and practice, 3rd Edition, New age international, 2007. 2. Van Wylen, Fundamentals of Classical Thermodynamics, John Wylie.
Reference books
1. H.A.Taha, Operations Research, 9th Edition, Prentice Hall of India, 2010. 2. F.S.Hillier, and G.J.Lieberman, Introduction to Operations Research, 7th Edition, TMH, 2009.
e- Resources & other digital material
1. https://nptel.ac.in/courses/111/105/111105039/
2. https://nptel.ac.in/courses/106/108/106108056/
3. https://nptel.ac.in/courses/111/104/111104071/
4. https://nptel.ac.in/courses/112/105/112105235/

PVP 19

PROJECT MANAGEMENT & OPTIMIZATION

Course Code	19ME2701C	**Year**	IV	**Semester**	I
Course Category	IDE-2	**Branch**	Common to all	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Industrial Engineering and Management
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Explain basics of project management	L2
CO2	Analyze activities involved in project.	L3
CO3	Describe various project cost management techniques	L2
CO4	Apply various Linear programming techniques and sequencing methods	L3
CO5	select transportation and assignment technique to minimize the cost	L3

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3			2		2			3	2	2	3
CO2	2	2	3	2	2				2		3	2	2	3
CO3	2	2	3			3		2			3	2	2	3
CO4	2	2	3			3		2			3	2	2	3
CO5	2	2	3			3		2			3	2	2	3
Average* (Rounded to nearest integer)	2	2	3	2	2	3		2	2		3	2	2	3

Syllabus

Unit No	Contents	Mapped CO
I	**Concepts of project management:** Meaning, definition and characteristics of a project, technical and socio-cultural dimensions; project life cycle phases, project planning and graphic presentation; work breakdown structure, manageable tasks; size of network; blow down NW; identity and logic dummy activity; Fulkerson rule for numbering NW; time-scaled NW	CO1
II	**NW analysis:** Network modelling, Probabilistic model-various types of activity times estimation, programme evaluation review techniques (PERT), probability of completing the project, deterministic model-critical path method (CPM), critical path calculation, crashing of simple of networks	CO2

III	**Project duration and control:** Importance and options to accelerate project completion; time cost trade off; fixed variable and total costs; use of floats and cost optimization; project performance measures; project monitoring info and reports; project control process; Gant chart and control chart; cost-schedule S-graph; planned cost of work schedule (PV), budgeted/ earned cost of work completed (EV) and actual cost of work completed (AC); schedule and cost variances (SV, CV) forecasting final project costs.	CO2
IV	**Linear programming:** Linear Programming Problem Formulation, Graphical solution Simplex method, artificial variables techniques-Two–phase method, Big-M method, Duality Principle **Sequencing**: Introduction, sequencing of n jobs through two machines, n jobs through three machines –two jobs through 'm' machines	CO3
V	**Transportation problem:** Formulation, Optimal solution, U-V method, unbalanced transportation problems, Degeneracy. **Assignment problem:** Formulation, Optimal solution, Variants of Assignment Problem-Traveling Salesman problem.	CO4

Learning Resource
Text books:
1. Prasanna Chandra, Projects Planning, Implementation and Control, Tata McGraw Hill Publishing Company Limited, New Delhi, 1995. 2. Operations Research, by S.D.Sharma, Kedarnath & Ramnath publications (15^{th}edition),2013
Reference books
1. Project Management Institute (PMI), A Guide to the Project Management of Knowledge Newton Square, PA, 1996 2. J.R. Meredith and S.J. Mantel, Project Management: A Managerial Approach. John Wiley and Sons, New York, 1995. 3. L.S. Srinath, PERT & CPM Principles & Applications, 3rd edition, East west Press, 2001. 4. Operations Research, (2nd edition) by R.Pannerselvam, 2009,PHI Publications, Noida
e- Resources & other digital material
5. https://nptel.ac.in/courses/105/106/105106149/
6. https://nptel.ac.in/courses/110/104/110104073/
7. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-ce06/
8. https://nptel.ac.in/courses/112/106/112106134/

PVP 19

COMMUNICATION NETWORKS LAB

Course Code	19EC3751	**Year**	IV	**Semester**	I
Course Category	Program Core	**Branch**	ECE	**Course Type**	Lab
Credits	1	**L-T-P**	0-0-2	**Prerequisites**	Nil
Continuous Internal Evaluation:	25	**Semester End Evaluation:**	50	**Total Marks:**	75

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Explain Communicate between two desktop computers (L3)
CO2	Implement different protocols (L3)
CO3	Program employing sockets (L3)
CO4	Apply and Evaluate various routing algorithms (L4)
CO5	select simulation tools (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3								2	
CO2	2	3	3	3	3								2	
CO3	2	2	3	3	3								2	
CO4	3	3	3	2	3								2	
Average* (Rounded to nearest integer)	3	3	3	3	3								2	

S No.	**Description**
1	Implementation of Error Detection / Error Correction Techniques
2	Implementation of Stop & Wait Protocol and sliding window
3	Implementation & Study of GO-Back N and selective repeat protocols
4	Implementation of High-level data link control
5	Implementation of IP commands such as PING, Trace route, NSLOOKUP
6	Implementation of distance vector routing algorithm
7	Implementation of link state routing algorithm
8	Study of network simulator & Simulation f congestion control algorithm using NS
9	Implementation of encryption & Decryption algorithm using programming language
10	Implementation of IP Address configuration

Learning Resource
e- Resources & other digital material
1. http://nptel.iitm.ac.in/courses/IIT-MADRAS/Computer_Networks/index.php

PVP 19

PROJECT PHASE I

Course Code	19EC3761	**Year**	IV	**Semester**	I
Course Category	Project work	**Branch**	ECE	**Course Type**	Project work
Credits	2	**L-T-P**	0-0-4	**Prerequisites**	--
Continuous Internal Evaluation:	100	**Semester End Evaluation:**	--	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Make use of the knowledge on contemporary issues to identify a problem requiring technology intervention. (L3)
CO2	Apply the knowledge of Electronics and Communication Engineering to design a circuit/system for solving the identified problem.(L3)
CO3	Create an effective project report. (L6)
CO4	Function in team and communicate effectively. (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3		3		3	3		3	3		3	3	3
CO 2	3		3		3							2	3	
CO 3				3	3			3	3	3	3	3		
CO 4								3	3	3		1		
Average* (Rounded to nearest integer)	3	3	3	3	3	3	3	3	3	3	3	3	3	3

PVP 19

CELLULAR AND MOBILE COMMUNICATIONS

Course Code	19EC1801A	**Year**	IV	**Semester**	II
Course Category	Program Elective VI	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	1. Analog Communications 2. Digital Communications
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret the cellular system design and technical challenges. (L2)
CO2	Analyze the effects for signal propagation (L4)
CO3	Analyze methodologies and mobile system specifications to improve the cellular capacity (L4)
CO4	Explain different generations of GSM systems and interpret the next generation cellular technologies. (L3)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1		1								3
CO2	3	3	3	1		1								3
CO3	3	3	3	1		1								3
CO4	2	2	3	1		1								3
Average* (Rounded to nearest integer)	3	3	3	1		1								3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Cellular and Mobile Radio Systems:** Introduction to Cellular Mobile System, Performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems Elements of Cellular Radio System Design: General description of the problem, concept of frequency Reuse channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni directional Antenna system, consideration of the components of Cellular system Interference: Introduction to Co-Channel Interference, real time Co-Channel interference, Co- Channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types.	CO1

II	**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, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation antenna height gain, form of a point to point model.	CO1,CO2
III	**Cell Site and Mobile Antennas:** Sum and difference patterns and their synthesis, omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas. Frequency Management and Channel Assignment: Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non-fixed channel assignment.	CO1,CO3
IV	**Handoffs:** Handoff, dropped calls and cell splitting, types of handoff, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation	CO1,CO3
V	**Digital Cellular and Mobile Networks:** GSM architecture, GSM channels, GSM Radio Subsystems, GSM Channels,4G evolution, Advantages of 4G over 3G,Applications of 4G, Limitations of 4G.5G evolution.	CO1,CO4

Learning Resources
Text Books
1. Mobile Cellular Telecommunications, W.C.Y. Lee, McGraw Hill, 2nd Ed, 1989. 2. Wireless Communications, T.S Rappaport, Pearson Ed., 2nd Ed., 2002.
Reference Books
1. Mobile Cellular Communication, Gottapu Sasibhushana Rao, Pearson Education, New Delhi, 2013. 2. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.3. John O. Attia, 3. Wireless Communication and Networking, Jon W. Mark and Zhqung, PHI, 2005.Cellular & Mobile Communications – Lee, Mc Graw Hill
e- Resources & other digital material
https://nptel.ac.in/courses/106/106/1061061067/ https://nptel.ac.in/courses/117104099/ https://swayam.gov.in/nd1_noc19_ee48/preview

PVP 19

SPEECH PROCESSING

Course Code	19EC1802B	**Year**	**IV**	**Semester**	II
Course Category	Program Elective-VI	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Signal Processing
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understanding fundamentals of speech processing and the process of speech production (L2).
CO2	Classify Signal Processing methods for Speech Recognition (L2)
CO3	Demonstrate different types of speech systems (L3)
CO4	Distinguish various HMM models (L4)
CO5	Differentiate Applications of Speech Recognition (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1		1	1	1	1	1	2
CO2	3	2	2	1	1	1	1		1	1	1	1	1	2
CO3	3	2	2	2	1	1	1		1	1	1	1	1	2
CO4	3	2	3	2	1	1	1		1	1	1	1	1	2
CO5	3	2	2	2	1	1	1		1	1	1	1	1	2
Average* (Rounded to nearest integer)	3	2	2	2	1	1	1		1	1	1	1	1	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Fundamentals of speech recognition:** Introduction, paradigm for speech recognition. **The speech signal:** The process of speech production and perception in human beings, the speech production process, representing speech in time and frequency domains, speech sounds and features.	CO1,CO2 & CO3
II	**Signal Processing and Analysis methods for Speech Recognition: Introduction,** Spectral analysis models. **The Bank-of-filters front-end processor**: types of filter banks, implementation of filter banks. **Linear predictive coding model for Speech recognition:** LPC model, LPC Analysis Equations, Auto correlation method, Covariance method and typical LPC analysis parameters.	CO1,CO2 & CO3

III	**Pattern Comparison Techniques:** Introduction, Speech detection, Distortion measures: Mathematical considerations, Perceptual considerations. Spectral distortion measures: Long spectral-distance, Cepstral-distance, Weighted Cepstral distances and Liftering, Likelihood distortions.	CO1,CO2 & CO3
IV	**Theory and Implementation of Hidden Markov Models:** Introduction, Discrete time Markov processes, Extensions to Hidden Markov models, Types of HMMs, comparison of HMMs,	CO1,CO4 & CO5
V	**Applications of Automatic Speech Recognition:** Introduction, Speech recognizer Performance scores, Characteristics of speech-Recognition Applications, Broad classes of Speech-Recognition Applications, Command and control Applications.	CO1,CO4 & CO5

Learning Resources
Text Books
1. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2007.
Reference Books
1. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.

PVP 19

FUNDAMENTALS OF SEMICONDUCTOR DEVICES

Course Code	19EC1801C	**Year**	IV	**Semester**	II
Course Category	Program Elective VI	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	10+2 physics
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Outline the atomic structure and basic concepts of crystals (L2)
CO2	Apply the knowledge on energy band theory, charge carrier concentrations and drift of carriers to describe the properties of materials (L3)
CO3	Develop small signal model of semiconductor devices and explain their characteristics (L3)
CO4	Solve the problems on biasing, switching and amplification circuits based on semiconductor devices (L3)
CO5	Analyse the functioning of basic electronic devices (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2		3									1		1
CO2	3		2									1		2
CO3	3		3									2		2
CO4	3		3									2		2
CO5	3		3									2		2
Average* (Rounded to nearest integer)	3		3									2		2

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**Crystal lattices**: Periodic structures, Cubic lattices, Planes and directions, Diamond lattice. **Atoms and Electrons**: Introduction to physical models, Experimental observations: The photoelectric effect, Atomic Spectra. The Bohr model, Quantum mechanics: Probability and the uncertainty Principle, The Schrodinger Wave Equation, Potential well problem, Tunneling. Excess carriers in Semiconductors (Qualitative treatment).	CO1
II	**Energy Bands and Charge carriers**: Bonding forces and Energy bands in solids: Bonding forces in solids, Energy bands, Metals, Semiconductors, and Insulators, Direct and Indirect Semiconductors. Charge carriers in Semiconductors: Electrons and holes, Effective mass, intrinsic material, extrinsic material.	CO2

	Carrier Concentrations: The Fermi level, Electron and Hole concentrations at Equilibrium, Temperature dependence of carrier concentrations, Compensation and Space charge Neutrality. Drift of carriers: Conductivity and Mobility, Drift and Resistance, Effects of Temperature and Doping on Mobility, High Field effects, Hall Effect.	
III	**P-N Junctions**: Equilibrium conditions: The contact potential, Equilibrium Fermi levels, Space charge at a junction. Forward and reverse biased Junctions; Steady state conditions: Qualitative Description of current flow at a junction, Carrier Injection, Reverse bias.Reverse-Bias Breakdown: Zener Breakdown, Avalanche Breakdown. Transient and A-C conditions: Time variation of stored charge, Reverse recovery Transient, Switching diodes, Capacitance of p-n junctions. Deviations from the Simple theory	CO3, CO4 and CO5
IV	**Field Effect Transistor:** The Metal-Insulator-Semiconductor FET: Basic operation, The Ideal MOS Capacitor, Effects of Real Surfaces, Threshold voltage, MOS Capacitance-Voltage Analysis. The MOS Field-Effect Transistor: Output Characteristics, Transfer characteristics, Mobility models, Short channel MOSFET I-V Characteristics, Control of Threshold voltage, Substrate Bias Effects, Sub threshold characteristics, Equivalent circuit for the MOSFET	CO3, CO4 and CO5
V	**Bipolar Junction Transistors**: Fundamentals of BJT Operation, Amplification with BJTs, Minority carrier Distributions and Terminal Currents: Solution of the diffusion equation in the base region, Evaluation of terminal currents, Approximations of the terminal currents, Current transfer ratio. Generalized Biasing: The coupled-diode model, Charge Control Analysis. Switching: Cutoff, Saturation, the Switching Cycle, and Specifications for Switching Transistors. Small-signal Equivalent circuit.	CO3, CO4 and CO5

Learning Resources
Text Books
1. Ben G. Streetman, Solid State Electronic Devices, Sixth Edition, Prentice Hall India, 2009. 2. Robert F. Pierret, Semiconductor device fundamentals, Pearson Publications, 2006.
Reference Books
1. Yuan Taur, Tak.H. Ning, Fundamentals of Modern VLSI Devices, Cambridge University Press, 1998 2. Donald Neamen, Semiconductors Physics and Devices, Tata Mc Graw Hill, 2003 3. Tyagi, Introduction to Semiconductor Materials and Devices, Wiley Publications, 2002. 4. S.M. Sze (Ed), Physics of Semiconductor Devices, 2nd Edition, Wiley Publications, 1998 5. Jasprit Singh, Semiconductor Devices, Basic Principles, Wiley Student Edition, 2001
e- Resources & other digital material
1. https://onlinecourses.nptel.ac.in/noc20_bt17/preview 2. https://www.youtube.com/watch?v=9h10p6M3Jo8

PVP 19

EMI and EMC TECHNIQUES

Course Code	19EC1801D	**Year**	IV	**Semester**	II
Course Category	Programme Elective-VI	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	EM Theory Communications
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Understand and Gain basic knowledge of problems associated with EMI and EMC from electronic circuits and systems
CO2	Analyze various sources of EMI and various possibilities to provide EMC
CO3	Analyze possible EMI prevention techniques such as grounding, shielding, filtering and use of proper coupling mechanisms to improve compatibility of electronic circuits and systems in a given electromagnetic environment.
CO4	Measure emission immunity level from different systems to couple with the prescribed EMC standards

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Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3												2
CO2	3	3	3	3	3	2						1		2
CO3	3	3	3	3	3	2						1		2
CO4	3	3	3	3	3	2						1		2
Average* (Rounded to nearest integer)	3	3	3	3	3	2						1		2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction**: Electromagnetic environment, history, concepts, practical experience and concerns, frequency spectrum conservations, an over-view of EMI/EMC, Overview on natural and nuclear sources of EMI.	CO1, CO2
II	**EMI from Apparatus and circuits :** Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive inter-modulation, cross-talk in transmission lines, transients in power supply lines, electromagnetic interference(EMI), Overview on Open area test sites and measurements	CO1, CO2

III	**Radiated and Conducted Interference Measurements :** Anechoic chamber, TEM cell, GH TEM cell, characterization of conduction Currents/voltages, conducted EM noise on power lines, conducted EMI from Equipment, immunity to conducted EMI detectors and measurements.	CO1, CO3
IV	**Grounding, Shielding and Bonding:** Principles and Types of grounding, shielding and bonding,	CO1, CO3
V	**Cables, Connectors and Components:** EMI suppression cables, EMC connectors, EMC gaskets, isolation transformers, opt isolators.	CO1, CO2, CO4

Learning Resources
Text Books
1.V.P.Kodali, Engineering Electromagnetic Compatibility,2/e, IEEE Press,2000
Reference Books
1.Clayton R Paul, Introduction to Electromagnetic Compatibility, John Wiley and Sons,2010 2. Electromagnetic Interference and Compatibility IMPACT series, IIT Delhi (Units1- 9)
E - Resources: 1. https://emcfastpass.com/emc-testing-beginners-guide/emc-books-resources-training/ 2. https://interferencetechnology.com/emc-resources/

PVP 19

EMBEDDED SYSTEMS

Course Code	19EC1801E	**Year**	IV	**Semester**	II
Course Category	Program Elective VI	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Apply design methodologies for embedded systems
CO2	Implement embedded systems design with specifications and technological choice.
CO3	Build fundamental systems such as sensors, actuators, converters, processors, intra- and inter-communication networks and interfaces.
CO4	Use modern hardware/software tools for building prototypes of embedded systems.

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	3	2	3							2	3	3
CO-2	3	3	3	2	3							2	3	3
CO-3	3	3	3	2	3							2	3	3
CO-4	3	3	3	2	3							2	3	3
EC7T4A*	3	3	3	2	3							2	3	3

Syllabus

Unit No.	Contents	Mapped CO
I	**Introduction to Embedded Systems:** Embedded systems vs general computing systems, history of embedded systems, classification of embedded systems, major application of embedded systems, purpose of embedded systems, elements of an embedded systems, core of the embedded systems, memory.	CO1
II	**Communication Buses in Embedded Systems:** On board communication interfaces: I2C, SPI bus,1 Wire bus, parallel interface, External Communication interfaces:RS-232,RS485,USB,IEEE 1394 firewire bus, IrDA, Bluetooth, Wi-Fi, Zigbee.	CO2, CO4
III	**Software Development Tools:** Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, In-circuit emulator, target hardware debugging, need for hardware-software partitioning and co-design, Overview of UML, scope of UML modeling, conceptual model of UML, architectural, UML basic elements-diagram- Modeling techniques - structural, behavioral, activity diagrams	CO2, CO3

IV	**Introduction to Real-Time Operating Systems:** A brief history of operating systems, defining an RTOS, the scheduler, introduction to task, task states and scheduling, round-robin scheduling algorithm, co-operative scheduling algorithm, pre-emptive scheduling algorithm, introduction to semaphores.	CO3
V	**Embedded System Application Development:** Objectives, different phases & modeling of the embedded product development life cycle (edlc), case studies on smart card- adaptive cruise control in a car - mobile phone software for key inputs.	CO3, CO4

Learning Resources
Text Books:
1. Rajkamal, 'Embedded system-Architecture, Programming, Design', 3e, TMH, 2017. 2. Shibu.K.V, "Introduction to Embedded Systems", Tata McGraw Hill,2017
References:
1. Peckol, "Embedded system Design",JohnWiley&Sons,2010 2. Lyla B Das," Embedded Systems-An Integrated Approach",Pearson,2013 3. Embedded/Real-Time Systems, Dr. K.V.K.K. Prasad, dream Tech press
e- Resources & other digital material
1. Microsoft PowerPoint - pcp_embedded_system_intro (iitb.ac.in) 2. NPTEL :: Electrical Engineering - Embedded Systems

PVP 19

MEMS AND NANOSENSORS

Course Code	19EC1801F	**Year**	IV	**Semester**	II
Course Category	Program Elective VI	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Explain the role of MEMS for various applications (L2)
CO2	Classify micro sensors& actuators used in MEMS and characterize them (L4)
CO3	Choose the suitable micro fabrication technology for given MEMS (L3)
CO4	Select suitable material and technology for MEMs Packaging (L3)
CO5	Categorize nano sensors and describe their characteristics (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2			2	2		2			2		2
CO2	2		3			3	3		3			2		3
CO3	2		3			3	3		3			2		3
CO4	2		3			3	3		3			2		3
CO5	2		3			3	3		3			2		3
Average* (Rounded to nearest integer)	2		3			3	3		3			2		3

Syllabus

Unit No.	Contents	Mapped CO
I	**Introduction:** Need for miniaturization, Microsystems versus MEMS, micro fabrication, smart materials, structures and systems, integrated microsystems: micromechanical structures, microsensors, microactuators, applications of smart materials and microsystems. Applications of MEMS in the automotive, health care, aerospace, industrial products, consumer products and telecommunications.	CO1

II	**Microsensors and actuators:** Silicon capacitive accelerometer, piezo resistive pressure sensor, conductometric gas sensor, electrostatic comb drive, a magnetic micro relay, portable blood analyzer, piezoelectric inkjet print head, micromirror array for video projection, micro-PCR systems, smart materials and systems.	CO2
III	**Micro fabrication technologies:** Silicon as a material for micromachining, Thin-film deposition, lithography, doping, etching, silicon micromachining: bulk and surface, specialized materials for microsystems: polymers and ceramic materials, advanced processes for micro fabrication: wafer bonding techniques, dissolved wafer processes, LIGA process, HexSil process.	CO3
IV	**MEMs Packaging:** Overview of Mechanical Packaging of Microelectronics, Micro-system Packaging, Interfaces in Micro-system Packaging, Essential Packaging Technologies, Three-Dimensional Packaging, Assembly of MEMS, Selection of Packaging Materials, Signal Mapping and Transduction, Design Case: Pressure Sensor Packaging.	CO4
V	**Nano Sensors:** Introduction to nano sensors, mechanical nano sensors, thermal nano sensors, magnetic nano sensors, optical nano sensors, chemical nano sensors and nano biosensors.	CO5

Learning Resources

Text Books

1. G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre, Micro and Smart Systems, Wiley India, 2010.
2. Tai-Ran Hsu, "MEMS and Microsystems: Design and Manufacture", Wiley, 2008.
3. Vinod Kumar Khanna, Nano sensors: Physical, Chemical and Biological, Series in Sensors, CRC press Taylor and Francis Group, 2012.

Reference Books

1. Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan, Smart Material Systems and MEMS: Design and Development Methodologies, John Wiley, 2006.
2. Mohamed GadelHak , The MEMS Handbook, University of Notre Dame,
3. M.-H. Bao, "Micromechanical Transducers: Pressure sensors, accelrometers, and gyroscopes", Elsevier, New York, 2000
4. M.J. Madou, "Fundamentals of Microfabrication",3rd Ed, CRC, 2011

e- Resources & other digital material

1. https://nptel.ac.in/courses/117/105/117105082/
2. https://www.edx.org/course/micro-and-nanofabrication-mems

PVP 19

INTRODUCTION TO PYTHON PROGRAMMING

Course Code	19CS2801A	**Year**	IV	**Semester**	II
Course Category	IDE - III	**Branch**	-	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	--
Continuous Internal Evaluation :	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		**Blooms Taxonomy Level**
Upon successful completion of the course, the student will be able to		
CO1	Understand the basic constructs of Python Programming.	L2
CO2	Apply Python Programming constructs to solve problems and make an effective report.	L3
CO3	Apply python packages to write programs for a given application.	L3
CO4	Analyze and choose appropriate data structure for solving problems	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:Substantial, 2: Moderate, 1:Slight)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3								3	3				
CO3	3													
CO4		3												
Average* (Rounded to nearest integer)	3	3							3	3				

Syllabus		
Unit No	**Contents**	**Mapped CO**
I	**Introduction to Python** Features of Python, Writing and Executing First Python Program, Literal Constants, Variables and Identifiers, Reserved Words, Data Types, Input Operation, Operators and Expressions, Operations on Strings, Type Conversion, Conditional statements and iterative statements.	CO1,CO2
II	**Functions in Python** Functions: Introduction, Built-in Math Functions, User Defined Functions: Function Call, Variable Scope and Lifetime, The return statement, Lambda Functions, Recursive functions Packages in python.	CO1,CO2

III	**Strings and File Handling in Python** **Strings:** Introduction, Built-in String Functions, Slice Operation, Comparing Strings, Iterating String, Regular Expressions. **File Handling:** open, close, read and write operations.	CO1, CO2
IV	**Data Structures in Python Lists:** Accessing values in lists, Nested Lists, Basic List Operations. **Tuples:** Creating Tuple, Accessing values in a tuple, Basic Tuple Operations. **Dictionaries**: Creating and Accessing Dictionaries, Built-in Dictionary functions, List Vs Tuple Vs Dictionary.	CO1,CO4
V	**Packages:** Numpy -- Create, reshape, slicing, operations such as min, max, sum, search, sort, math functions etc. Pandas -- Read/write from csv, excel, json files, add/ drop columns/rows, aggregations, applying functions Matplotlib -- Visualizing data with different plots, use of subplots.	CO1,CO3

Learning Resources
Text books
1. Python Programming using Problem Solving Approach, Reema Thareja, 2017, OXFORD University Press 2. Python for Data Analysis, Wes McKinney, 2012, O.Reilly.
References
1. Core Python Programming, R. Nageswara Rao, 2018, Dreamtech press. 2. Programming with python, T R Padmanabhan, 2017, Springer.
e-Resources and other Digital Material
1. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf **2.** https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf

PVP 19

INSTRUMENTATION AND SENSOR TECHNOLOGIES OF CIVIL ENGINEERING APPLICATIONS

Course Code	19EC2801A	**Year**	IV	**Semester**	II
Course Category	Inter Disciplinary Elective III	**Branch**	Common to all	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	--
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Summarize various performance characteristics of instruments and the quality of measurement (L2)
CO2	Interpret the type of transducer based on the transduction principles(L2)
CO3	Identify the relevant transducer for measurement of physical quantities (L3)
CO4	Discover the additional attributes in advanced sensors and their role in Civil Engineering(L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1										2
CO2	2	1	2	1										2
CO3	2	1	2	1										2
CO4	2	1	2	1										2
Average* (Rounded to nearest integer)	2	1	2	1										2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction:** Definition of sensor/transducer-Block Diagram-elements of measurement system-classification of sensors/transducers-static characteristics-accuracy, precision, resolution, linearity, sensitivity, range, loading effect, threshold, dead time, dead zone, span. **Errors in measurement**: True value, static error, static correction, scale range and scale span, error calibration curve, readability, repeatability & reproducibility, drift and noise	CO-1

II	**Resistive Transducers:** Potentiometers-Linear POT, Rotary POT, characteristics of POT. Thermistors- Construction and its Resistance- Temperature characteristics. Thermocouples- Construction and its Resistance-emf characteristics **Inductive Transducers**: Principle of change of self inductance, Principle of change of mutual inductance, Linear variable differential transformer (LVDT), Rotary variable differential transformer (RVDT).	CO-2, CO-3
III	**Capacitive Transducers**: Introduction-Variable area type-variable air gap type- differential arrangement in capacitive transducers, variation of dielectric constant for measurement of liquid level, , variation of dielectric constant for measurement of displacement, advantages & disadvantages of Capacitive transducers . **Piezoelectric Transducers**: Measurement of Force, Modes of operation of Piezoelectric crystals, properties of Piezoelectric crystals, use of Piezoelectric Transducers.	CO-2, CO-3
IV	**Hall effect Transducers:** Hall effect element, Measurement of displacement, current and power. **Optical Transducers:** Vacuum photo emissive cell and its characteristics, semi conductor photo electric transducer- Photo conductive cell and its characteristics, photo diode and its characteristics, photo voltaic cell and its characteristics.	CO-2, CO-3
V	**Digital and Smart Sensors:** Introduction to digital encoding transducer- digital displacement transducers- shaft encoder-optical encoder, Introduction to Smart Sensors, Overview in Applications of sensors in Civil Engineering.	CO-4

Learning Resources

Text Books

1. A.K.Ghosh, "Introduction to Measurements & Instrumentation", IIIrd ed, PHI
2. A.K.Sawhney & Puneet Sawhney, "A Course in Mechanical Measurements & Instrumentation", Dhanapat Rai & Co.
3. D.V.S.Murty, "Transducers & Instrumentation", PHI.

Reference Books

1. Raman Pallas-Arney& John G.Webster, "Sensors & Signal Conditioning", 2012.
2. D.Patranabis, "Sensors and Transducers" 2nd edition, PHI, 2013.
3. BC Nakra, KK Chaudhry "Instrumentation, Measurement and Analysis", 2ndEdition,TMH

PVP 19

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Course Code	19HS2801A	**Year**	IV	**Semester**	II
Course Category	Inter Disciplinary Elective-III	**Branch**	Common to all	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	--
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	To understanding of the fundamental logistics and supply chain management concepts.
CO2	The ability to apply knowledge to evaluate and measuring logistics costs and performance.
CO3	To understanding of the foundational role of logistics as it relates to Source and transportation.
CO4	To awareness on how to align the management of a supply chain with corporate goals and strategies.
CO5	The capability to analyze and improve pricing product and documentation

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Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2								3	3	
CO2	3	3		2								3	3	
CO3	3	3		2								3	3	
CO4	3	3		2								3	3	
CO5	3	3		2								3	3	
Average* (Rounded to nearest integer)	**3**	3		2								3	3	

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Logistics Management**: Introduction, Objectives, Concept of Logistics, Objectives of logistics, Types of logistics, Concept of Logistics Management, Evolution of Logistics, Role of Logistics in an Economy, Difference between Logistics and Supply Chain Management.	**CO1**
II	**Measuring logistics costs and performance**: The concept of Total Cost analysis – Principles of logistics costing – Logistics and the bottom-line – Impact of Logistics on shareholder value.	**CO2**
III	**Logistics and Supply chain relationships**: Benchmarking the logistics process and SCM operations –Mapping the supply chain processes – Supplier and distributor benchmarking–identifying logistics performance indicators – Channel structure.	**CO3**

IV	**Sourcing and Transporting:** sourcing decisions and transportation in supply chain – infrastructure suppliers of transport services – transportation economics.	**CO4**
V	**Pricing Product and Documentation:** Pricing - Revenue Management Lack of coordination and Bullwhip Effect - Impact of lack of coordination - Documentation - functions and types.	**CO5**

Learning Resource

Text books:

1. Donald J.Bowersox and David J.Closs: "Logistical Management" The Integrated Supply Chain Process, TMH, 2011.
2. Edward J Bradi, John J Coyle: "A Logistics Approach to Supply Chain Management, Cengage Learning, New Delhi, 2012.

Reference books

1. D.K.Agrawal: "Distribution and Logistics Management", MacMillan Publishers, 2011
2. Sunil Chopra and Peter Meindl: "Supply chain Management: Strategy, Planning and Operation", Pearson Education, New Delhi 2013
3. Rahul V Altekar: Supply Chain Management, PHI Learning Ltd, New Delhi, 2009

PVP 19

TOTAL QUALITY MANAGEMENT

Course Code	19ME2801A	**Year**	IV	**Semester**	II
Course Category	Inter Disciplinary Elective-III	**Branch**	Common to all	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	--
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Develop an understanding on quality management philosophies and frameworks	L2
CO2	Acquire knowledge of quality costs and leadership	L2
CO3	Illustrate concepts of customer focus, continuous quality improvement and supplier partnership	L2
CO4	Explain TQM tools to improve management processes.	L2
CO5	Determine the set of indicators to evaluate performance excellence of an organization	L2

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2				2	3		3	3	1	2	1	3	2
CO2	2				2	3		3	3	1	2	1	3	2
CO3	2				2	3		3	3	1	2	1	3	2
CO4	2				2	3		3	3	1	2	1	3	2
CO5	2				2	3		3	3	1	2	1	3	2
Average* (Rounded to nearest integer)	**2**				2	3		3	3	1	2	1	3	**2**

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction:** Definition of Quality, Factors effecting quality, Quality management, Quality Dimensions, four phases of quality, Total Quality, Salient features of Total Quality Management (TQM)-definition of TQM, Elements of TQM, Principles of TQM, Pillars of TQM, Traditional Approach and TQM Approach. **Characteristics of TQM:** TQM Enablers, Approaches, relevance, Barriers to TQM Implementation	CO1
II	**Quality costs:** Cost classification, Basic cost of quality. Applications and Importance of quality cost. **Quality leadership:** Quality of leadership, Quality of successful leader, leadership for TQM, Deming Philosophy, Contributions of Gurus of TQM	CO2

III	**Customer Focus:** Customer Complaints and suggestions, panels, Customer satisfaction, Customer Perception of Quality, Customer driven quality circles, Customer focus and activities, needs and expectations, Organizations action from the customer point of view. **Continuous Quality Improvement** - Juran Trilogy, PDCA Cycle, Kaizen-kaizen suggestions, program introduction at work place, principles of kaizen. Supplier Partnership -Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development	CO2
IV	**TQM Tools:** Benchmarking - Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) - House of Quality, QFD Process, Benefits. Taguchi Quality Loss Function. Total Productive Maintenance (TPM) - Concept, Improvement Needs, FMEA - Stages of FMEA, the seven tools of quality, Process Capability-Concept, Methods of calculating process capability, Process capability index, Concept of six sigma.	CO3
V	Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, documentation Quality Auditing – QS 9000 - ISO 14000 - Concepts, Requirements and Benefits – TQM, Implementation in manufacturing and service sectors.	CO4

Learning Resource
Text books:
3. Dale H.Besterfiled, "Total Quality Management", Pearson Education, Delhi, 2006. 4. K. C. Arora, "Total Quality Management", Kataria & sons. New Delhi, 2005.
Reference books
4. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2005. 5. Narayana V and Sreenivasan N.S., Quality Management - Concepts and Tasks, New Age International, Delhi, 1996.
e- Resources & other digital material
1. https://nptel.ac.in/courses/110/105/110105039/
2. https://nptel.ac.in/courses/110/104/110104085/
3. https://nptel.ac.in/courses/110/104/110104080/#
4. https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-mg18/

PVP 19

PROJECT PHASE II

Course Code	19EC3861	**Year**	IV	**Semester**	II
Course Category	Project work	**Branch**	ECE	**Course Type**	Project work
Credits	7	**L-T-P**	0-0-14	**Prerequisites**	--
Continuous Internal Evaluation:	100	**Semester End Evaluation:**	100	**Total Marks:**	200

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Develop a circuit/system using technology and software tools. (L3)
CO2	Assess the impact of the developed solution in societal/global context. (L5)
CO3	Create an effective project report. (L6)
CO4	Function in team and communicate effectively. (L4)

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Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1			3		3							2	3	
CO 2				3	3	3	3	3	3	3	3	3	3	3
CO 3				3	3			3	3	3	3	3		
CO 4								3	3	3		1		
Average* (Rounded to nearest integer)			3	3	3	3	3	3	3	3	3	2	3	3
