PRASAD V POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY
(Autonomous)

ACADEMIC RULES & REGULATIONS (PVP19)
and
FOUR YEAR B.Tech Course Structure, First Year Syllabus

Applicable for the batch of students admitted from the Academic Year 2019-2020

Electrical & Electronics Engineering

PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY
(Autonomous)
AICTE approved, NBA & NAAC Accredited, An ISO 9001:2015 certified Institution
Permanently Affiliated to Jawaharlal Nehru Technological University
Kakinada
Kanuru, Vijayawada -520 007, Andhra Pradesh
Phone:0866 2581699
e-mail: principal@pvpsiddhartha.ac.in
www.pvpsiddhartha.ac.in

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PREFACE

PVP Siddhartha Institute of technology, established in 1998, is one of the seventeen educational institutions sponsored and run by Siddhartha Academy of General & Technical Education. The 250 members of the Academy are a group of industrialists, educationists, auditors and philanthropists with vast experience in their respective fields and above all with an ardent desire to spread quality Education. All the academic organizations of Siddhartha Academy stand symbolic of the pragmatic vision of its founders. PVP Siddhartha Institute of Technology has the advantage of inheriting the higher academic standards. The college is approved by AICTE and is permanently affiliated to JNTUK. It is certified by ISO 9001-2015 for its quality standard. It is accredited by the National Board of Accreditation and NAAC with A^+ grade. Moreover, it is an Autonomous College.

The curriculum is revised continuously to address the challenges of industry and academia and to foster the global competencies among the students. The curriculum is revised two times since 2012. The present curriculum(PVP19) is designed incorporating the features such as outcome based approach, Choice Based Credit System, encouraging self-learning through MOOCs platforms i.e., Swayam, Courses Era, EDX, NPTEL, etc., Transformation of creative ideas into a prototype through project phase I & phase II, enhancing depth & breadth by introducing more number of programs, open & interdisciplinary electives in core and multi-disciplinary areas, offering courses by industry experts to improve Industry Institute Interaction in addition to internships at industry and introduction of wide range of value added courses beyond curriculum to choose according to their interest to enhance their skills and employability.

Institute Vision

To provide rich ambience for Academic and Professional Excellence, Research, Employability skills, Entrepreneurship and Social responsibility.

Institute Mission

To empower the students with Technical knowledge, Awareness of up-to-date technical trends, Inclination for research in the areas of human needs, Capacity building for Employment / Entrepreneurship, Application of technology for societal needs.

Quality Policy

At PVPSIT, We commit ourselves to offer Quality professional education in engineering & Management by adhering to applicable statutory and regulatory requirements and through continuous improvement in the Quality of our services by,

- Regular up gradation of knowledge and skills of faculty
- Improving the teaching methods and strategies
- Providing state of art infrastructure
- Recruiting competent faculty and maintaining prescribed Teacher Student ratio
- Improving the employability of students
- Enhanced Collaboration with industry and institutions of National Repute

EEE Department Vision

To mould young and fresh minds into well disciplined and competent engineers to excel in the field of Electrical & Electronics Engineering to cater the industrial /societal needs and compete at global level.

EEE Department Mission

To produce competent and quality technical professionals with strong basics of electrical engineering principles and techniques

To facilitate the students to work with modern tools, state of art technologies, innovative research capabilities besides inculcating leadership abilities and ethical values.

EEE Department Program Educational Objectives

PEO-I: Have a strong foundation in engineering fundamentals, mathematics, basic sciences, humanities and modern software tools with ability to apply them to conceive, analyze, design and implement solutions to problems in electrical engineering field.

PEO-II: Have a broad based background to practice electrical engineering in the areas of control systems, machines, measurements, power systems, power electronics and their applications in industry and government sectors meeting the growing expectations of stake holders.

PEO-III: Have requisite skills to excel in a multidisciplinary engineering environment with awareness of contemporary issues, professional responsibility, impact of technology on society, and the need for life-long learning.

PEO-IV: Have an ability to pursue higher studies to meet the needs of global standards and participate in team oriented, open ended activities both as team members and as leaders with professional communication skills to compete in global scenario.

Program Outcomes

PO - 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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

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

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

PO - 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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

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

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

PO - 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

PO - 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

EEE Department Program Specific Outcomes

PSO - 1: To develop technical knowledge, skill and competence to identify, comprehend and solve problems in Electrical and Electronics Engineering.

PSO - 2: To demonstrate technical competence in solving problems related to electrical engineering applying updated and apt methodologies which lead for sustainable development.

CONTENTS

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 here under 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 about minimum 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 Government of Andhra Pradesh.

5.2 CATEGORY – B Seats

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

5.3 CATEGORY - Lateral Entry Seats

Lateral entry candidates shall be admitted into the III semester directly as per 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 on student'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 terms of SGPA calculated as shown in equation (1).

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

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).

$$CGPA = \frac{\sum CR \times GP}{\sum CR(for\ all\ courses\ offerd\ \ up\ to\ that\ semester/\ entire\ prgram)} --(2)$$

Where CR = Credits of a course

GP = Grade points awarded for a course

Percentage equivalent of CGPA = (CGPA – 0.5) * 10

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 cover the 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 the guidance of a faculty member and carrying out a detailed feasibility study, literature survey and submit a report regarding work plan for the project 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 of VI 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.

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
Regulation	**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 and 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	0- Theory 1-Theory studied in MOOCS Mode 5- Practical 6- Project Work 7- Industrial Training/ Internship	i.e. Course sequence Number in that semester	Incase if the course is Elective then this field will specify the 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 semester examinations 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 the division on par with other regular students.

8.4.9 The students who have earlier history of indulging in malpractices in semester end examinations 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 of examinations 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 two assignment 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 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.

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 40 Marks 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 department and 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 the end 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 below:

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 end examination.

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.

9.4.4 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.

9.4.5 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 EXAMINATIONAND 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 totaling the number of periods of lectures, tutorials, drawing, practical and project work as the case may be, held in every course as 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 in Regulations **10.1.**

10.2.2 Further, a student shall be eligible for promotion to V / VII Semester of 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 along with 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 is as 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 Honorable 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 violation of the code of conduct and are liable to invoke disciplinary measures.

i. Lack of courtesy and decorum; indecent behaviour anywhere within or outside the 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

	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	The candidate who has impersonated shall be

	other candidate in connection with the examination.	expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	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 forfeiture 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-	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.

	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 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.	

Note: Special squads may be formed to oversee the proper conduct of examinations.

18 OTHER MATTERS

18.1 Scribe facility is extended to B Tech students strictly following the guidelines issued under F. No. 16-110/2003-DD.III Dt. 26-02-2013 by the Ministry of Social Justice and Empowerment, Department of Disability Affairs, Govt. of India.

18.2 Students who are suffering from contagious diseases are not allowed to appear either continuous internal assessment or semester end examinations.

18.3 The students who participate in coaching/tournaments held at State/National/International levels through University/Indian Olympic Association during semester end examination period will be promoted to subsequent semesters till the entire programme is completed as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated18-08-1994.

18.4 Based on the recommendations of HOD & Principal, exemption from attending the class work shall be given to those students who secure placement and intend to join as the employer in VIII semester of B.Tech. Special Continuous Internal Evaluation (Assignment Tests, Sessional, etc.,) will be arranged to such candidates separately if necessary.

However, they shall appear for Semester End Examinations as per the Academic 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 decision of 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 the areas 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

B.Tech
COURSE STRUCTURE

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF ELECTRICAL & ELECTRONICS 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

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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
19EE3251	Electrical 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

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF ELECTRICAL & ELECTRONICS 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
19EE3301	Electrical Circuit Analysis	3	0	0	3	30	70	100
19EE3302	Electronic Devices &Circuits	3	0	0	3	30	70	100
19EE3303	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
19EE3351	Electrical Circuit Analysis Lab	0	0	3	1.5	25	50	75
19EE3352	Electronic Devices &Circuits Lab	0	0	3	1.5	25	50	75
Total		19	0	10	21	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 ELECTRICAL & ELECTRONICS ENGINEERING

II B.TECH - II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19BS1401	Engineering Mathematics-IV (Numerical Methods, Probability and Statistics)	3	0	0	3	30	70	100
BS1404	Life Sciences for Engineers	2	0	0	2	30	70	100
19EE3401	Electrical Machines -I	3	0	0	3	30	70	100
19EE3402	Digital Logic Design	3	0	0	3	30	70	100
19EE3403	Analog Circuits	3	0	0	3	30	70	100
19EE3404	Electromagnetic Fields	3	0	0	3	30	70	100
19MC1401	Environmental Sciences	3	0	0	0	100		100
BS1451	Life Sciences for Engineers Lab	0	0	2	1	25	50	75
19EE3451	Electrical Machines –I Lab	0	0	3	1.5	25	50	75
19EE3452	Digital Logic Design Lab	0	0	3	1.5	25	50	75
19EE3453	Analog Circuits 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 ELECTRICAL & ELECTRONICS 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
19EE3501	Control Systems Engineering	3	0	0	3	30	70	100
19EE4501	Program Elective-I	3	0	0	3	30	70	100
19EE3502	Electrical Machines-II	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
19EE3551	Electrical Machines-II lab	0	0	3	1.5	25	50	75
19EE3552	Control Systems Engineering Lab	0	0	3	1.5	25	50	75
Total		17	0	8	21	255	570	825

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
19EE3601	Power Systems-I	3	0	0	3	30	70	100
19EE4601	Program Elective-II	3	0	0	3	30	70	100
19EE3602	Microprocessors & Microcontrollers	3	0	0	3	30	70	100
19EE4602	Program Elective-III	3	0	0	3	30	70	100
19EE3603	Power Electronics	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
19EE3651	Microprocessors & Microcontrollers Lab	0	0	3	1.5	25	50	75
19EE3652	Power Electronics Lab	0	0	3	1.5	25	50	75
Total		24	0	6	24	360	590	950

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

IV B. TECH – I SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19HS1701	Organization Behavior	3	0	0	3	30	70	100
19EE3701	Power Systems-II	3	0	0	3	30	70	100
19EE4701	Program Elective-IV	3	0	0	3	30	70	100
19EE4702	Program Elective-V	3	0	0	3	30	70	100
	Interdisciplinary Elective II	3	0	0	3	30	70	100
19EE3751	Power System-II Lab	0	0	2	1	25	50	75
19EE3761	Project Phase-I	0	0	4	2	100		100
19EE3771	Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions				2	75		75
Total		15	0	6	20	350	400	750

IV B.TECH - II SEMESTER

Course Code	Title	L	T	P	Credits	Internals	Externals	Total
19EE4801	Program Elective-VI	3	0	0	3	30	70	100
	Inter Disciplinary Elective III	3	0	0	3	30	70	100
19EE3861	Project Phase-II	0	0	14	7	100	100	200
Total		6	0	14	13	160	240	400

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

Inter Disciplinary Electives

Offered By	Subject	Course Code	Title	L	T	P	Credits	Internals	Externals	Total
CSE	Inter Disciplinary Elective-I	19CS2501C	Data Base Management Systems	3	0	0	3	30	70	100
MBA	Inter Disciplinary Elective-I	19HS2501C	Quantitative Techniques for Management	3	0	0	3	30	70	100
IT	Inter Disciplinary Elective-I	19IT2501C	OOP with C++	3	0	0	3	30	70	100
ME	Inter Disciplinary Elective-I	19ME2501A	Computational methods	3	0	0	3	30	70	100
EEE	Inter Disciplinary Elective-II	19EE2701C	Renewable Energy Resources	3	0	0	3	30	70	100
IT	Inter Disciplinary Elective-II	19IT2701C	Web Technologies	3	0	0	3	30	70	100
ME	Inter Disciplinary Elective-II	19ME2701B	Optimization Techniques	3	0	0	3	30	70	100
ME	Inter Disciplinary Elective-II	19ME2701C	Project Management & Optimization	3	0	0	3	30	70	100
CSE	Inter Disciplinary Elective-III	19CS2801D	Introduction to Python Programming	3	0	0	3	30	70	100
ECE	Inter Disciplinary Elective-III	19EC2801B	Instrumentation and Sensor Technologies of Civil Engineering Applications	3	0	0	3	30	70	100
MBA	Inter Disciplinary Elective-III	19HS2801A	Logistics and Supply Chain Management	3	0	0	3	30	70	100
ME	Inter Disciplinary Elective-III	19ME2801B	Total Quality Management	3	0	0	3	30	70	100

Prasad V. Potluri Siddhartha Institute of Technology

Course Structure for B. Tech under PVP19 regulations

(Effective from Academic Year 2019-20)

Open Electives

Subject	Course Code	Title	L	T	P	Credits	Internals	Externals	Total
Open Elective I	19ES5501A	Biotechnology and Society	3	0	0	3	30	70	100
Open Elective I	19ES5501B	Electrical Safety	3	0	0	3	30	70	100
Open Elective I	19ES5501C	Fundamentals of Cyber Law	3	0	0	3	30	70	100
Open Elective I	19ES5501D	Environment and Ecology	3	0	0	3	30	70	100
Open Elective I	19HS5501A	Contemporary Relevance of Indian Epics	3	0	0	3	30	70	100
Open Elective I	19HS5501B	Indian National Movement	3	0	0	3	30	70	100
Open Elective I	19HS5501C	Engineering for Community Service	3	0	0	3	30	70	100
Open Elective I	19HS5501D	Personality Development	3	0	0	3	30	70	100
Open Elective I	19HS5501E	Introduction to International Business	3	0	0	3	30	70	100
Open Elective I	19HS5501F	Gandhian Philosophy	3	0	0	3	30	70	100
Open Elective I	19HS5501G	Indian History	3	0	0	3	30	70	100
Open Elective II	19ES5601A	Environmental Management	3	0	0	3	30	70	100
Open Elective II	19ES5601B	Telecommunication for Society	3	0	0	3	30	70	100
Open Elective II	19HS5601A	German for Beginners	3	0	0	3	30	70	100
Open Elective II	19HS5601B	Chinese for Beginners	3	0	0	3	30	70	100
Open Elective II	19HS5601C	Analytical Essay Writing	3	0	0	3	30	70	100
Open Elective II	19HS5601D	Indian Economy	3	0	0	3	30	70	100
Open Elective II	19HS5601E	Public Administration	3	0	0	3	30	70	100
Open Elective II	19HS5601F	National Service Scheme	3	0	0	3	30	70	100
Open Elective II	19HS5601G	Professional Communication	3	0	0	3	30	70	100
Open Elective II	19HS5601H	Basics of Finance	3	0	0	3	30	70	100
Open Elective II	19HS5601I	Basics of Marketing	3	0	0	3	30	70	100

B.Tech Syllabus

Communicative English - I

Course Code	19HS1101	Year	I	Semester	I
Course Category	Humanities	Branch	EEE	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	
CO 1	Comprehend how to apply parts of speech in a sentence and construct a paragraph.
CO 2	Apply grammar to formulate text using punctuation.
CO 3	Evaluate reading texts and use correct tense forms for effective communication.
CO 4	Analyze reading texts and to write summaries based on comprehension of the texts.
CO 5	Create awareness on how to write correct sentences in English and comprehend the text.

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
CO 1										3		3	1	
CO 2										3		3	1	
CO 3										3		3	1	
CO 4										3		3	1	
CO 5										3		3	1	

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.	CO 1
II	**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help 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	CO 2
III	**Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and	CO 3

	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 processes or 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 of antonyms	CO 4
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)	CO 5

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 Game Reading 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

Engineering Mathematics – I (Calculus and Algebra)

Course Code	19BS1101	Year	I	Semester	I
Course Category	Basic Sciences	Branch	EEE	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	
CO 1	Utilize the techniques of matrix algebra that is needed by engineers for practical applications
CO 2	Apply mean value theorems to engineering problems
CO 3	Utilize functions of several variables in optimization
CO 4	Employ the tools of calculus for calculating the areas
CO 5	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
CO 1	3	2											2	1
CO 2	3	2											2	1
CO 3	3	2											2	1
CO 4	3	2											2	1
CO 5	3	2											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.	CO 1
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).	CO 2
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.	CO 3
IV	Multiple Integrals-I :Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.	CO 4
V	Multiple Integrals-II: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volume as triple integral.	CO 5

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, 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
1. www.nptelvideos.com/mathematics/ 2. https://nptel.ac.in/courses/111104025/ 3. https://nptel.ac.in/courses/122101003/

Engineering Physics

Course Code	19BS1104	Year	I	Semester	I
Course Category	Basic Sciences	Branch	EEE	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	
CO 1	Apply the fundamental laws of electricity and magnetism to currents and propagation of EM waves.
CO 2	Identify the propagation of light and demonstrate the loss mechanisms in optical fibers.
CO 3	Explain the principles of physics in dielectrics, magnetic materials and identify the mechanisms of polarization for useful engineering applications.
CO 4	Classify solids and calculate carrier concentration and conductivity in semiconductors.
CO 5	Demonstrate the functioning of solar cell, photodiode, and semiconductors devices for engineering applications.

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
CO 1	3	3											3	
CO 2	3	3											3	
CO 3	3	3											3	
CO 4	3	3											3	
CO 5	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	CO 1
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	CO 2

	sensors (Temperature, displacement and force), applications.	
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.	CO 3
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.	CO 4
V	**Semiconductor devices** Drift and diffusion currents in semiconductors, Hall effect and its applications, magnetoresistance, p-n junction layer formation and V-I characteristics, direct and indirect band gap semiconductors, construction and working of photodiode, LED, solar cell	CO 5

Learning Resources
Text Books
1. Engineering Physics, R.K.Gaur& S.L.Gupta, Dhanpatrai Publications. 2. Solid State Physics , S.O.Pillai, New Age International.
Reference Books
1. A Text Book Of Engineering Physics, M.N.Avadhanulu & P.G.Kshrisagar, S.Chand Publications 2. Semiconductor Devices & Physics, S.M.Sze,Wiley,2008. 3. Applied Physics, P.K. Palanai Swamy, Scitech Publications. 4. Engineering Physics, Dr.M.Arumugam, Anuradha Publications. 5. Introduction To Electrodynamics, David.J.Griffths, Pearson Education.
e- Resources & other digital material
http://physicsforidiots.com/physics/electromagnetism/ https://www.arcelect.com/fibercable.htm http://freevideolectures.com/Course/3048/Physics-of-Materials/36 https://www.iitk.ac.in/mse/electronic-materials-and-devices https://link.springer.com/chapter/10.1007/978-3-319-48933-9_35

Basic Electrical & Electronics Engineering

Course Code	19ES1101	Year	I	Semester	I
Course Category	Engineering Sciences	Branch	EEE	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	
CO 1	To familiarize the basic DC and AC networks used in electrical and electronic circuits.
CO 2	To explain the concepts of electrical machines and their characteristics.
CO 3	To identify the importance of transformers in transmission and distribution of electric power.
CO 4	To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
CO 5	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
CO 1	3	2					1		1		2	1	2	1
CO 2	3	2				1	1		1		2	1	2	1
CO 3	3	2				1	1		1		2	1	2	1
CO 4	3	2					1		1		2	1	2	
CO 5	3	2					1		1		2	1	2	

Syllabus

Unit No.	Contents	Mapped CO
I	Basic laws and Theorems: Ohms law, Kirchhoff's Laws, series and parallel circuits, source transformations, delta-wye conversion. Mesh analysis, nodal analysis. Linearity and superposition theorem, Thevenin's and Norton's theorems with simple examples, maximum power transfer theorem with simple examples.	CO 1
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.	CO 2
III	Transformers: Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short- circuit tests and determination of efficiency. Three Phase Induction Motors: Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.	CO 3
IV	Semiconductor Devices: P-N Junction diode - Basic operating principle,	CO 4

	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.	
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, Differential amplifiers, A Single Op-amp differential amplifier.	CO 5

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.
e- Resources & other digital material
http://202.53.81.118/course/view.php?id=122 https://nptel.ac.in/courses/108105112/

Engineering Graphics

Course Code	19ES1103	Year	I	Semester	I
Course Category	Engineering Sciences	Branch	EEE	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	
CO 1	Conic sections and curves used in engineering practice.
CO 2	Orthographic projections of points, lines, planes and solids.
CO 3	Isometric and orthographic views.
CO 4	Development of lateral surfaces of solids.
CO 5	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
CO 1	3									3	1		1	
CO 2	3									3	1		1	
CO 3	3									3	1		1	
CO 4	3									3	1		1	
CO 5	3				3					3	1		1	

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. a) **Conic sections**: Construction of ellipse, parabola and hyperbola (general method only) b) **Cycloidal curves**: Cycloid, Epicycloid and Hypocycloid c) **Involutes**: Involute of regular polygons and Circle.	CO 1
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.	CO 2
III	**Projections of solids:** Projections of regular solids such as cube, prism, p cylinder and cone (Treatment limited to solids inclined to one of the referen **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)	CO 3
IV	**Orthographic Views:** Systems of projections, conversion of	CO 4

	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)	
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)	CO 5
	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# isodrawing, 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.

Communicative English – I Lab

Course Code	19HS1151	Year	I	Semester	I
Course Category	Humanities	Branch	EEE	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	
CO 1	Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills
CO 2	Apply communication skills through various language learning activities
CO 3	Analyze the comprehensive ability and logical thinking for better listening and speaking.
CO 4	Evaluate and exhibit acceptable etiquette essential in social and professional situations.
CO 5	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
CO 1									2	3		3	1	
CO 2									2	3		3	1	
CO 3									2	3		3	1	
CO 4									2	3		3	1	
CO 5									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.	CO 1
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.	CO 2
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.	CO 3
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.	CO 4
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.	CO 5
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

Engineering Physics Lab

Course Code	19BS1153	Year	I	Semester	I
Course Category	Basic Sciences	Branch	EEE	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	
CO 1	Assess the intensity of the magnetic field of circular coil carrying current with varying distance and utilize four probe set up to measure resistance.
CO 2	Evaluate the acceptance angle of an optical fiber and numerical aperture and loss.
CO 3	Demonstrate the importance of dielectric material and measure magnetic parameters.
CO 4	Identify the type of semiconductor using hall effect and determine the band gap of a semiconductor.
CO 5	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**
CO 1	3		3										2	
CO 2	3		3										3	
CO 3	3		3										2	
CO 4	3		3										3	
CO 5	3		3										3	

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	To Determine The Magnetic Field Along The Axis Of A Circular Coil Carrying Current	CO 1
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	CO 2
IV	To Determine The Dielectric Constant Of A Substance By Resonance Method	CO 3
V	To Determine The Resistivity Of Semiconductor By Four Probe Method	CO 4
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	CO 5
IX	To Study The Characteristics Of PN Diode	
X	To Study The Characteristics Of Solar Cell	

Learning Resources
Text Books
RamaraoSri,ChoudaryNityanand 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

Basic Electrical & Electronics Engineering Lab

Course Code	19ES1151	Year	I	Semester	I
Course Category	Engineering Sciences	Branch	EEE	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	
CO 1	To familiarize the basic DC and AC networks used in electrical and electronic circuits.
CO 2	To explain the concepts of electrical machines and their characteristics.
CO 3	To identify the importance of transformers in transmission and distribution of electric power.
CO 4	To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
CO 5	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
CO 1	3	2	2	1					1		1	1	1	1
CO 2	3	2	2	1			1		1		1	1	1	1
CO 3	3	2	2	1			1		1		1	1	1	1
CO 4	3	2	2	1			1		1		1	1	1	1
CO 5	3	2	2	1			1		1		1	1	1	1

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	Verification of Kirchhoff's Laws KVL and KCL.	CO 1
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.	CO 2
V	OC and SC Tests on single phase transformer.	CO 3
VI	Brake Test on DC shunt motor.	CO 2
VII	Current Voltage Characteristics of a p-n Junction Diode/LED	CO 4
VIII	Diode Rectifier Circuits.	
IX	Voltage Regulation with Zener Diodes.	
X	Inverting and Non-inverting Amplifier Design with Op-amps	CO 5

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.

Engineering Mathematics – II (ODE, PDE and Multivariable Calculus)

Course Code	19BS1201	**Year**	I	**Semester**	II
Course Category	Basic Sciences	**Branch**	EEE	**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	
CO 1	Solve the differential equations related to various engineering fields.
CO 2	Solve the linear differential equation with constant coefficients.
CO 3	Identify solution methods for partial differential equations that model physical processes.
CO 4	Interpret the physical meaning of gradient, curl and divergence .
CO 5	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)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	3	2											2	1
CO 2	3	2											2	1
CO 3	3	2											2	1
CO 4	3	2											2	1
CO 5	3	2											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.	CO 1
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.	CO 2
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.	CO 3
IV	**Multivariable Calculus (Vector Differentiation):**Scalar and vector point	CO 4

	functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities	
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).	CO 5

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/

Engineering Chemistry

Course Code	19BS1203	Year	I	Semester	II
Course Category	Basic Sciences	Branch	EEE	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	
CO 1	List various sources of renewable energy.
CO 2	Compare different types of cells.
CO 3	Explain the merits of fuel cells.
CO 4	Identify suitable methods for metal finishing.
CO 5	Distinguish between nanoclusters and nanowires, 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
CO 1	3													1
CO 2	3													1
CO 3	3		3											1
CO 4	3		3											1
CO 5	3													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.	CO 1
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 MnO_2 cell- challenges of battery technology. Fuel cells- Introduction - classification of fuel cells – hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuel cell.	CO 2
III	RENEWABLE SOURCES OF ENERGY Introduction- sources of renewable energy Solar energy – Introduction - Physical and Chemical properties of Silicon-	CO 3

	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	
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	CO 4
V	POLYMERS, NANOMATERIALS AND MOLECULAR MACHINES & SWITCHES: Polymers: Introduction thermoplastic and thermo setting resins, Preparation, properties and uses of polystyrene and Polyphosphazines., differences between Nanomaterials: Introduction to nanomaterial: nanoparticles, nanocluster, carbon nanotube (CNT) and nanowires. Chemical synthesis of nanomaterials: 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	CO 5

Learning Resources
Text Books
1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, DhanapatRai& 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, DhanapathRai and sons, (2003) 2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, 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, M murthyPublications (2014). 5. K. SeshaMaheshwaramma 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

Problem Solving and Programming

Course Code	19ES1202	Year	I	Semester	II
Course Category	Engineering Sciences	Branch	EEE	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	
CO 1	Develop algorithm and flowchart for simple problems.
CO 2	Understand the structure, fundamentals and decision making statements in C.
CO 3	Choose suitable iterative statements and arrays to solve the problems.
CO 4	Solve problems using functions and pointers.
CO 5	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)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2										1	2	2
CO 2	1	1											2	2
CO 3	2	2	2									1	2	2
CO 4	2	2	2									1	2	2
CO 5	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.	CO 1
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.	CO 2
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.	CO 3

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.	CO 4
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.	CO 5

Learning Resources
Text Books
1. R.G. Dromey, How to Solve it by Computer, 1/e, Pearson Education, 2006. (for Unit 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

Engineering Chemistry Lab

Course Code	19BS1251	Year	I	Semester	II
Course Category	Basic Sciences	Branch	EEE	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	
CO 1	Explain the functioning of the instruments such as pH, Conductometric and Potentiometric methods.
CO 2	Identify different ores (Cr & Cu) and their usage in different fields (industry, software devices, electronic goods).
CO 3	Experiment with the physical parameter of organic compounds.
CO 4	Compare the viscosities of oils.
CO 5	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
CO 1	3		2											1
CO 2	3		2											1
CO 3	3		2											1
CO 4	3		2											1
CO 5	3		2											1

Syllabus

Expt. No.	Contents	Mapped CO
I	Determination of strength of an acid by pH metric method	CO 1
II	Determination of conductance by conductometric method	
III	Determination of viscosity of a liquid	CO 4
IV	Determination of surface tension of a liquid	CO 3
V	Determination of chromium (VI) in potassium dichromate	CO 2
VI	Determination of Zinc by EDTA method	
VII	Estimation of active chlorine content in Bleaching powder	CO 3
VII	Preparation of Phenol-Formaldehyde resin	CO 5
IX	Preparation of Urea-Formaldehyde resin	
X	Thin layer chromatography	CO 3

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

Problem Solving and Programming Lab

Course Code	19ES1252	Year	I	Semester	II
Course Category	Engineering Sciences	Branch	EEE	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	
CO 1	Build algorithm and flowchart for simple problems.
CO 2	Use suitable control structures to solve problems.
CO 3	Use suitable iterative statements and arrays to solve the problems.
CO 4	Implement Programs using functions and pointers.
CO 5	Develop code for complex applications using structures, unions and file handling features.

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
CO 1	2	2										1	1	1
CO 2	2	2	2		2							1	1	1
CO 3	2	2	2		2							1	1	1
CO 4	2	2	2		2							1	1	1
CO 5	2	2	2		1							1	1	1

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	Draw flowcharts for fundamental algorithms.	CO 1
II	C Programs to demonstrate C-tokens.	CO 2
III	C Programs on usage of operators.	
IV	C Programs to demonstrate Decision making and branching (Selection)	
V	C programs to demonstrate different loops.	CO 3
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.	CO 4
X	C programs on pointers.	
XI	C programs on structures and unions.	CO 5
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

Basic Workshop

Course Code	19ES1253	Year	I	Semester	II
Course Category	Engineering Sciences	Branch	EEE	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	
CO 1	Apply wood working skills in real world applications
CO 2	Build different parts with metal sheets in real world applications.
CO 3	Apply fitting operations in various applications.
CO 4	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)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3					1			3		1		1	
CO 2	3					1			3		1		1	
CO 3	3					1			3		1		1	
CO 4	3					1			3		1		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 i) Half – Lap joint. ii) Mortise and Tenon joint. iii) Corner Dovetail joint or Bridle joint.	CO 1
Sheet Metal Working	Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets i) Tapered tray ii) Conical funnel ii) Elbow pipe	CO 2
Fitting	Familiarity with different types of tools used in fitting and do the following fitting exercises i) V-fit ii) Semi-circular fit iii) Bicycle tire puncture and change of two wheeler tire	CO 3
Electrical	Familiarities with different types of basic electrical circuits and	CO 4

Wiring	make the following connections i) Preparation of a circuit for Parallel and series connection. ii) Preparation of a circuit Go down lighting using Two way switch and tube light. iii) Soldering of wires	

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

Electrical Workshop

Course Code	19EE3251	Year	I	Semester	II
Course Category	Program Core	Branch	EEE	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	
CO 1	Familiarize with electrical tools, symbols ,cables and switch gear device
CO 2	Understand the wiring of various electrical circuits
CO 3	Measure various electrical quantities
CO 4	Learn the procedure to start various DC and AC machines

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
CO 1	3		2			2	2	2			2	2	2	1
CO 2	3		2			2	2	2			2	2	2	1
CO 3	3		2			2	2	2			2	2	2	1
CO 4	3		2			2	2	2			2	2	2	1

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	Study of various electrical tools and symbols	CO 1
II	Identify different types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage	
III	Wiring of light/fan circuit using two way/three way control (Staircase wiring)	CO 2
IV	Go-down wiring / Tunnel wiring	
V	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, Main switch and Energy meter.	
VI	Wiring of backup power supply including inverter, battery and load for domestic installations	
VII	Measurement of voltage, current, resistance in DC circuit.	CO 3
VIII	Measurement of voltage, current and power in single phase circuit using voltmeter, ammeter and wattmeter. Calculate the power factor of the circuit	
IX	Starting of DC shunt motor using three-point starter.	CO 4
X	Starting of DC series motor using two-point starter.	
XI	Starting of single-phase induction motor.	
XII	Starting of three phase induction motor	

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.

ENGINEERING MATHEMATICS-III
(PDE, COMPLEX VARIABLES &TRANSFORM TECHNIQUES)

Course Code	19BS1301	**Year**	II	**Semester**	I
Course Category	Basic Sciences course	**Branch**	EEE	**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	Find Laplace transforms of given functions.
CO2	Find inverse Laplace transforms of the given functions and able to apply Laplace transforms to solve differential equations with initial conditions.
CO3	Determine complex potential function and evaluate integrals by applying Cauchy's integral formula and write series expansions of complex functions.
CO4	Expand given function in terms of sine and cosine terms in Fourier series and also to get knowledge in Fourier transforms.
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)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2											2	
CO2	3	2											2	
CO3	3	2											2	
CO4	3	2											2	
CO5	3	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** 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	CO4

	formula, Taylor's series, Laurent's series. (All theorems/properties without proofs)	
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 Resource(s)
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/

AI TOOLS

Course Code	19ES1301	**Year**	II	**Semester**	I
Course Category	ES	**Branch**	EEE	**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)

	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

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 Goodfellow , 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/

DESIGN THINKING & PRODUCT INNOVATION

Course code	19ES1302	**Year**	II	**Semester**	I
Course category	Engineering Science	**Branch**	EEE	**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 correlation
1:Slight (low), 2: Moderate (medium) 3: Substantial (High)

	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
CO5			3	2		1			2	2	1	1		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 materials, definition of product and its classification. Innovation towards product design Case studies.	CO4
V	**Design Thinking In Business Processes:**	CO5

	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.	

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-Centred Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World by IDEO
Additional Learning Resources
https://www.interaction-desiqn.ora/literature/topics/desiqn-th/nkinq
https://www.interaction-desiqn.prq/literature/article/how-tq-<eve'op-an-empath\capproach-in-design-thinking

ELECTRICAL CIRCUIT ANALYSIS

Course Code	19EE3301	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisite**	BEEE (19ES1101)
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 concepts of single phase AC circuits, AC Power Analysis, resonance and circuit theorems.
CO2	**Explain** magnetic coupled circuits and different configurations of three phase circuits.
CO3	**Apply** circuit analysis concepts & theorems to solve electrical networks.
CO4	**Analyze** two port network parameters and three phase circuits.
CO5	**Analyze** the steady state behavior, time response of electrical networks.

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	3	2
CO2	2	2										1	3	2
CO3	3	2										1	3	2
CO4	2	3										1	3	2
CO5	2	3										1	3	2

Syllabus		
Unit No.	Contents	Mapped CO
I	Sinusoids, Phase, Phase difference, Phasors, phasor relationships for circuit elements. Complex and polar form representations, J-notation, Effective values of current and voltage. Instantaneous power, average power, Apparent power, real power, reactive power, power triangle, complex power, power factor. Steady state analysis of RL, RC and RLC circuits with simple examples.	CO1 CO5
II	**Resonance:** Series resonance, Parallel resonance, bandwidth, quality factor. Super Mesh and Super Node, Reciprocity theorem, Millman's theorem, Compensation theorem and Tellegen's theorem.	CO1 CO3
III	**Transient Analysis:** Time response of RL, RC, RLC series circuits for Zero input, Step input, sinusoidal excitation - Initial conditions-solution approach using differential equation and Laplace transforms.	CO5
IV	Magnetically coupled circuits, Self Inductance, Mutual Inductance, Coupling coefficient, Dot convention.	CO2 CO4

	Two port networks - impedance parameters, admittance parameters, Hybrid parameters and Transmission parameters, relationships between parameters.	
V	**Three –phase circuits:** Phase sequence, Relation between line and phase voltages and currents in balanced systems – Analysis of balanced three phase circuits – two wattmeter method for measurement of active & reactive power, measurement of three phase reactive power using one wattmeter method.	CO2 CO4

Learning Resources

Text Books

1. Van Valkenburg M.E, 'Network Analysis', 3/e, Prentice Hall India .
2. William H. Hayt Jr., Jack E. Kemmerly, 'Engineering Circuit Analysis', 8/e, McGraw Hill.
3. Charles K.Alexander, Mathew N.O.Sadiku,"Fundamentals of Electric Circuits" (Fifth Edition), Tata McGraw-Hill.

Reference Books

1. Sudhakar and Shyammohan S Palli, Circuits and Networks: Analysis and Synthesis, Fifth Edition, McGraw-Hill Education.
2. Syed A.Nasar, 3000 solved problems in Electric Circuits, 1st Edition, Schaum's outline series McGraw-Hill Professional.
3. A.Chakrabarti, Circuit Theory – Analysis and Synthesis', 7/e, Dhanpat Rai and Company.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/105/108105112/

ELECTRONIC DEVICES AND AMPLIFIER CIRCUITS

Course Code	19EE3302	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**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 analyze 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.

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		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

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 of MOS differential	CO4

	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
http://www.faadooengineers.com/threads/4615-Electronic-Devices-and-Circuit-Theory-Boylestad-and-Nashelsky https://docplayer.net/53934331-J-b-gupta-electronic-devices-and-circuits.html

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SIGNALS AND SYSTEMS

Course Code	19EE3303	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**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.

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	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

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 signals. Properties of the Continuous-time Fourier transform, Systems characterized by linear constant-coefficient differential equations.	CO3
	Fourier analysis of Discrete Time Signals and Systems: The Discrete-Time Fourier Transform, Properties of the Discrete-time Fourier transform, The	CO4

IV	Fourier transform for periodic signals. Systems characterized by linear constant-coefficient difference equations.	
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.HamidNawab, 'Signals and Systems', 2/e, Pearson Education, 1997.
Reference Books
1. Bhagawandas 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. Signals and Systems using MATLAB, Kindle Edition, Luis Chaparro
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

CONSTITUTION OF INDIA

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

Unit No.	Contents
I	**Introduction to Indian Constitution:** Constitutional history, constituent assembly, salient features of the constitution, significance of preamble, amending process of the constitution.
II	**Rights and Duties:** Citizenship, fundamental rights and directive principles, fundamental duties.
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.
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.
V	**Other Constitutional and Statutory Bodies:** Comptroller and auditor gen-eral, 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).

Learning Resources

Text Books

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.

Reference Books

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.

AI TOOLS LAB

Course Code	**19ES1351**	**Year**	II	**Semester**	I
Course Category	ES	**Branch**	EEE	**Course Type**	Practical
Credits	1	**L-T-P**	0-0-2	**Prerequisite**	-
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 pre-processing 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 (3: High, 2: Medium, 1: 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

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 Goodfellow , 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

DESIGN THINKING & PRODUCT INNOVATION LAB

Course code	19ES1352	**Year**	II	**Semester**	I
Course category	Engineering science	**Branch**	Common to all	**Course Type**	Lab
Credits	2	**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 correlation
1: Slight (low), 2: Moderate (medium) 3: Substantial (High)

	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

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 sprintbase software	CO4
14	Design thinking using sprintbase 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
https://www.interaction-desiqn.ora/literature/topics/desiqn-th/nkinq
https://www.interaction-desiqn.prq/literature/article/how-tq-<eve'op-an-empath\capproach-in-design-thinking

ELECTRICAL CIRCUIT ANALYSIS LAB

Course Code	19EE3351	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisite**	BEEE Lab (19ES1151)
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	**Inspect** network theorems.
CO2	**Plot** the frequency response of series RLC circuits and their resonance conditions.
CO3	**Determine** two port network parameters and self, mutual inductance of coupled circuits.
CO4	**Analyze** three phase power drawn by balanced circuits.
CO5	**Simulate** and analyze electrical circuits using Pspice tools.

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					1			1	3	2
CO2	3	3		2					1			1	3	2
CO3	3	3		2					1			1	3	2
CO4	3	3		2					1			1	3	2
CO5	3	3		2	2				1			2	3	2

Syllabus		
Expt. No.	Contents	Mapped CO
PART-A (Any Eight Experiments)		
1	Verification of Maximum Power Transfer Theorem	CO1
2	Verification of Reciprocity Theorem	
3	Verification of Millman‘s Theorem	
4	Verification of Compensation Theorem	
5	Series and Parallel Resonance with frequency variations	CO2
6	Determination of Self, Mutual Inductances and Coefficient of coupling	CO3
7	Determination of impedance and admittance Parameters	
8	Determination of Transmission and hybrid parameters	
9	Measurement of Active & Reactive Power using two wattmeter method	CO4
10	Measurement of Reactive Power using one wattmeter method	
PART-B: PSPICE SIMULATION OF ELECTRIC CIRCUITS (Any Two Experiments)		
11	Mesh and Nodal Analysis using PSpice	CO5
12	Verification of Thevenin‘s and Norton‘s Theorem using PSpice	

13	Verification of Superposition theorem using PSpice	
14	DC Transient response using PSpice	
15	AC Transient response using PSpice	

Learning Resources

Text Books

1. Charles K.Alexander, Mathew N.O.Sadiku,"Fundamentals of Electric Circuits" (Fifth Edition)**,** Tata McGraw-Hill.
2. Sudhakar and Shyammohan S Palli, Circuits and Networks: Analysis and Synthesis, Fifth Edition, McGraw-Hill Education.

ELECTRONIC DEVICES AND AMPLIFIER CIRCUITS LAB

Course Code	19EE3352	**Year**	II	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**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.

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	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

Syllabus

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

9	Analysis and Verification of Basic NMOS Differential Pair for Gain, Input Common Mode Range, Maximum Input differential voltage requirements	CO3
10	Design and Simulation of Differential Amplifier with active current mirror load for gain, power dissipation CMRR requirements.	CO3
11	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
https://www.researchgate.net/publication/314154179_Electronics_Lab_Manual http://abexp.aiaiai.dk/electronic_devices_and_circuits_lab_manual_bgpltd.pdf

ENGINEERING MATHEMATICS-IV

(NUMERICAL METHODS, PROBABILITY AND STATISTICS)

Course Code	19BS1401	**Year**	II	**Semester**	II
Course Category	Basic Sciences Course	**Branch**	EEE	**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 approximate root of an equation and apply different methods to calculate the value of interpolating polynomial at given point
CO2	Evaluate integrals making use of quadrature formulae and solve ordinary differential equations by Euler's, R.K. methods.
CO3	Use discrete and continuous distribution models to calculate probabilities for appropriate random variables.
CO4	Understand and apply the basic concepts of inferences concerning means and proportions to the decision making process.
CO5	Interpret hypotheses test for small samples.

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	
CO2	3	2											2	
CO3	3	2											2	
CO4	3	2											2	
CO5	3	2											2	

Syllabus		
Unit No.	Contents	Mapped COs
I	**Solution to Algebraic and Transcendental Equations** Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson's method. Finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formula.	CO1
II	**Numerical Differentiation and Integration** Numerical Differentiation- Newton's forward and backward difference formulae, numerical integration- trapezoidal rule, Simpson's $\frac{1}{3}^{rd}$ and $\frac{3}{8}^{th}$ rules. Ordinary differential equations: Euler's, modified Euler's, Runge-Kutta method of fourth order for solving first order equations.	CO2

III	**Probability** Random variables (discrete and continuous), probability density functions, probability distribution: Binomial - Poisson - normal distribution and their properties (mathematical expectation and variance).	CO3
IV	**Testing of Hypothesis** Formulation of null hypothesis, critical regions, level of significance. Large sample tests: Test for single proportion, difference of proportions, test for single mean and difference of means.	CO4
V	**Small Sample Tests** Student's t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test)	CO5

Learning Recourse(s)
Text Book(s)
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44/e, 2019. 2. T.K.V.Iyenger, Krishna Gandhi and others, Probability & Statistics, S. Chand.
Reference Book(s)
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006. 2. Miller and Freund's, Probability and Statistics for Engineers, Pearson.
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/

LIFE SCIENCES FOR ENGINEERS

Course Code	19BS1404	Year	II	Semester	II
Course Category	Basic Sciences	Branch	EEE	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 basic 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							

	Syllabus	
Unit NO	Contents	Mapped POS
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, Epistasis, 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 Resources

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 Wileyand Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012.

ELECTRICAL MACHINES-I

Course Code	19EE3401	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisite**	Basic Electrical and Electronics Engineering (19ES1101)
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 of magnetic circuits, construction, operation of D.C machines, single phase transformer, auto transformer and three phase transformer.
CO2	**Classify** the performance characteristics of D.C machines, single phase transformer, auto transformer and three phase transformer.
CO3	**Analyze** the speed control methods and testing techniques of D.C machines.
CO4	**Analyze** the testing techniques of single phase transformer and three phase transformer.
CO5	**Analyze** the different configurations of D.C machines, single phase transformer, auto transformer and three phase transformer.

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												2	
CO2	2	2				2		1			1	2	2	2
CO3	2	2				2		1			1	2	2	2
CO4	2	2				2		1			1	2	2	2
CO5	2	2				2		1			1	2	2	2

Syllabus		
Unit No.	Contents	Mapped CO
I	Magnetic circuits: Definition of magnetic quantities, analysis of magnetic circuits- series, parallel, leakage flux, comparison of magnetic and electric circuits. B-H curve of magnetic materials; flux- linkage vs current characteristic of magnetic circuits; Energy in Magnetic Systems-Field energy and mechanical force-singly and doubly excited magnetic field systems- forces and torques in systems with electromagnets.	CO1
II	DC Generators: Principle of operation, armature winding - lap and wave windings, separately and self-excited generators, armature reaction-cross magnetization and demagnetization AT/pole, compensating winding, commutation process, methods of improving commutation, voltage build-up	CO1 CO2 CO5

	in a shunt generator, critical field resistance and critical speed, internal and external characteristics of shunt, series and compound generators, parallel operation.	
III	DC Motors: Principle of operation, characteristics of shunt, series and compound motor, speed control methods, 4-point starter- design of starter elements, losses in DC machine, testing of DC machine – No load test, load test, Hopkinson's test , retardation test and field test.	CO1 CO2 CO3
IV	Single-Phase Transformers: Principle of operation, ideal transformer, transformer under no load and on load with Phasor diagrams, equivalent circuit, condition for maximum efficiency and voltage regulation, all day efficiency. Determination of equivalent circuit parameters, efficiency at different loadings and regulation using O.C and S.C test, polarity test, back-to-back test, separation of hysteresis and eddy current losses, Parallel operation of single-phase transformers.	CO1 CO2 CO4 CO5
V	Autotransformers - construction, principle of operation, applications and comparison with two winding transformer. Three-Phase Transformers: Types of connection and their comparative features, Scott connection, Tap-changing transformers - No- load and on-load tap-changing of transformers.	CO1 CO2 CO4 CO5

Learning Resources

Text Books

1. Dr.P. S Bimbhra, ― Electrical Machinery-7/e -Khanna Publishers,2018.
2. I.J. Nagarath and D.P. Kothari, ―Electric Machines‖, 4/e, McGraw Hill, 2010.
3. A.E. Fitzgerald, Charles Kingsley Jr. Stephen D. Umans, ― Electric Machinery, 7/e, McGraw,Hill.,2013.

Reference Books

1. J.B. Gupta , ―Theory and performance of Electrical Machines- Katson Publishers.
2. A.E. Clayton and N N Hancock,― Performance and Design of DC Machines‖,Oxford,1987
3. Abhijit Chakrabarti, Sudipta Debnath, ― Electrical Machines, 1/e, Mc Graw Hill,2015.
4. S.J. Chapman, ―Electric Machine Fundamentals, 5/e, McGraw Hill, 2011.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/105/108105155/

DIGITAL LOGIC DESIGN

Course Code	19EE3402	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**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.

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	3							1	2	1
CO5	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

ANALOG CIRCUITS

Course Code	19EE3403	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**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	Design and analyze feedback amplifiers.
CO2	Design and analyze Power amplifier and oscillator Circuits.
CO3	Realize linear and non-linear circuits using op-amp
CO4	Design and Understand various timing and filter circuits using 555 IC
CO5	Compare the performance of various types of ADC and DAC Circuits

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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	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

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.

ELECTROMAGNETIC FIELDS

Course Code	19EE3404	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisite**	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	**Define, understand** and **explain** concepts on electrostatics, magnetostatics and time varying fields.
CO2	**Apply** basic laws and theorems to determine the electrostatic and magneto static fields.
CO3	**Analyze** different parameters of static electric and magnetic fields.
CO4	**Calculate** capacitance and inductance of common conductor configurations and energy stored.
CO5	**Analyze** time varying fields and compute the energy stored in electromagnetic fields.

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							1			1	1	
CO2	3	2							1			1	2	
CO3	3	3							1			1	2	
CO4	3	2							1			1	2	
CO5	3	3							2			1	2	

Syllabus

Unit No.	Contents	Mapped CO
I	**Static Electric Field – I** Coulomb‘s law, Electric field intensity, Electrical field due to point charges, Line Charges (Derivations Only) – Infinite, Finite and Circular Ring, Surface charges (Derivations Only) – Infinite sheet and Circular Disk. Electric Flux Density, Gauss law and applications of Gauss’s Law to Point Charges, Infinite Line Charge, Infinite Sheet of Charge, Co-axial cable, Spherical shell and Uniformly charged sphere. Divergence and Divergence theorem. Energy expended in moving a charge in an electric field, Absolute Electric potential, Potential difference, Calculation of potential difference for point charges, Potential Gradient.	CO1, CO2, CO3
II	**Static Electric Field – II** Poisson‘s and Laplace‘s equations, Solution of Laplace equations in one variable Electric dipole, Dipole moment, potential and electric filed due to an electric dipole, Torque on an Electric dipole in an electric field. Electrostatic Energy and Energy density. Current and current density,	CO1,

	Ohms Law in Point form, Continuity of current equation. Electric field inside dielectric material - concept of Polarization, Boundary conditions between conductor dielectric and two dielectric materials. Capacitance, Capacitance of parallel plate, Spherical, Co-axial capacitors and parallel plates with Composite Dielectric.	CO2, CO3, CO4
III	**Static Magnetic Fields** Biot - Savart Law, Magnetic Field Intensity (MFI), MFI due to straight current carrying filament, circular, square and solenoid current carrying loops. Magnetic flux and flux density. Ampere circuital Law, Applications of Ampere's circuital law to infinite sheet of current and a long current carrying filament. Point form of Ampere's circuital law.	CO1, CO2, CO3
IV	**Magnetic Forces and Inductance** Force on a moving charge, Lorentz force equation, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic dipole and dipole moment, a differential current loop as a magnetic dipole, Torque on a current loop placed in a magnetic field Inductances and mutual inductances, determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane, energy stored and energy density in a magnetic field.	CO1, CO2, CO3, CO4
V	**Time Varying Fields** Faraday's law for Electromagnetic induction, Displacement current, Point form and Integral form of Maxwell's equations, Uniform plane waves, Wave equation, solution of wave equation, wave propagation through good dielectric, good conductor, skin depth, Poynting Theorem.	CO1, CO5

Learning Resources

Text Books

1. Mathew N. O. Sadiku "Elements of Electromagnetics," Oxford University Press, 2018
2. William H. Hayt, Jr. .John A. Buck, M Jaleel Akhtar "Engineering Electromagnetics", McGraw-Hill, 9thEdition, 2020

Reference Books

1. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, 2nd edition, New Delhi, 2008.
2. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
3. John D Kraus, *"Electromagnetics*", McGraw Hill, 2003.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/106/108106073/#
2. https://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring-2008/

ENVIRONMENTAL SCIENCES

Course Code	19MC1404	**Year**	II	**Semester**	II
Course Category	Mandatory course	**Branch**	EEE	**Course Type**	Theory
Credits	0	**L-T-P**	3-0-0	**Prerequisite**	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	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 (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							

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**	CO2

	Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem, 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 Resources
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).

LIFE SCIENCES FOR ENGINEERS LAB

Course Code	19BS1451	**Year**	II	**Semester**	II
Course Category	Basic Sciences	**Branch**	EEE	**Course Type**	Lab
Credits	1	**L-T-P**	0-0-2	**Prerequisite**	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							
CO5	3						2							

Syllabus		
Expt. No	Contents	Mapped CO
1	Microscopy	CO1, CO3
2	Dissect & mount different parts of plants using Microscope	CO1, CO3
3	Estimation of Proteins by using Biuret method	CO1, CO2
4	Estimation of enzyme activity.	CO1, CO2
5	Estimation of chlorophyll content in some selected plants.	CO1, CO3
6	Nitrogen Cycle: Estimation of Nitrates /Nitrites in soil by using Spectrophotometer	CO2,CO3
7	Mendal's laws	CO1, CO4
8	Solve Problems based on Mapping .	CO2, CO4

ELECTRICAL MACHINES-I LAB

Course Code	19EE3451	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisite**	Basic Electrical and Electronics Engineering Lab (19ES1151)
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** the magnetization characteristics and performance of D.C generators.
CO2	**Classify** the characteristics of DC motor and determine efficiency of D.C machine.
CO3	**Classify** the characteristics and testing methods of single-phase transformers.
CO4	**Analyze** the performance of three phase transformers.

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	2		2		2		1			1	2	2	2
CO2	2	2		2		2		1			1	2	2	2
CO3	2	2		2		2		1			1	2	2	2
CO4	2	2		2		2		1			1	2	2	2

Syllabus		
Exp No.	Contents	Mapped CO
	PART-A Compulsory	
1.	Magnetization and load characteristics of DC shunt generator	CO1
2.	Speed control of DC shunt motor by field and armature control	CO2
3.	Hopkinson‘s test on D.C shunt machines.	CO1,CO2
4.	Field’s test on D.C series machines.	CO1,CO1
5.	Determination of equivalent circuit parameters and voltage regulation using OC and SC tests on single phase transformer	CO3
6.	Parallel operation of two single phase transformers.	CO3
7.	Scott connection of transformers.	CO4
8.	Separation of losses in single phase transformer	CO3
	PART-B: Any Two Experiments	
9.	Load test on DC series generator.	CO1
10.	Load test on DC compound generator.	CO1
11.	Brake test on DC Compound motor	CO2
12.	Separation of losses in DC shunt machine	CO1, CO2

13.	Load test on single phase transformer.	CO3
14.	Sumpner's test on single phase transformers.	CO3

Learning Resources

Text Books

1. Dr.P. S Bimbhra-Electrical Machinery-7/e -Khanna Publishers,2018.
2. I.J. Nagarath and D.P. Kothari, ―Electric Machines, 4/e, McGraw Hill,2010.
3. A.E. Fitzgerald, Charles Kingsley Jr. Stephen D. Umans, ‒Electric Machinery 7/e, McGraw,Hill.,2013

DIGITAL LOGIC DESIGN LAB

Course Code	19EE3452	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**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 stable tables of different Flipflops.
CO4	Design & Verify counters using different Flipflops.

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	3							1	2	1

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
1	Verification of Truth Tables of Logic gates and implementation of Basic gates using Universal Gates.	CO1
2	Implementation of the given Boolean functions using logic gates in both SOP and POS form.	CO1
3	Simplification of the given Boolean function using K-map and implement using logic gates.	CO1
4	Realization and verification of Full adder and Full Subtractor using logic gates.	CO2
5	Implementation of the given function using decoder and logic gates	CO2
6	Implementation of the given function using decoder and logic gates.	CO2
7	Verification of State Tables of SR, D, JK and T-Flip-Flops	CO3
8	Design and Verify the operation of 4-bit Synchronous Counter using T flip-flops.	CO4

9	Design and Verify the operation of 4-bit and Mod-N Ripple Counters using JK flip-flops	CO4
10	Mini Project	CO4

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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ANALOG CIRCUITS LAB

Course Code	19EE3453	**Year**	II	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**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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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	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

Syllabus

Expt. No.	Contents	Mapped CO
1	Feedback Amplifier - calculation of gain, input resistance, output resistance with and without feedback, frequency response characteristic.	CO1
2	Design and Implementation of Two stage RC Coupled amplifier for given voltage, current gain & bandwidth.	CO1
3	RC phase-shift, Wein-bridge ,Colpitts Oscillators	CO2
4	Class A power amplifier.	CO2
5	Class B Push - pull power amplifier.	CO2
6	Tuned voltage amplifier.	CO2
7	Analysis and simulation of RC differentiator/integrator	CO3
8	Operational Amplifier Circuits (Adders, Integrators, Differentiators, Filters)	CO3

9	Opamp based AM/FM Modulator/Demodulator Circuits.	CO3
10	Bistable/Monstable/Astable-multivibrators with 555 timer and using 741	CO4
11	Active Filter Design (LPF AND BANDPASS types)	CO4
12	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.

INTERNET OF THINGS

Course Code	19ES1504	**Year**	III	**Semester**	I
Course Category	ES	**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..
CO2	Illustrate diverse methods of deploying smart objects and connect them to network.
CO3	Construct simple applications using Arduino..
CO4	Interpret different protocols and select which protocol can be used for a specific application.
CO5	Identify and develop a solution for a given application using APIs.

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

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, Application Layer Protocols HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.	CO4
V	Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security,	CO5

	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.	

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

CONTROL SYSTEMS ENGINEERING

Course Code	19EE3501	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Signals and Systems (19EE3303) & Engineering Mathematics-III (19BS1301)
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, feedback characteristics and describe some applications.
CO2	**Determine** the transfer function and recognize different mathematical modeling of physical systems.
CO3	**Demonstrate** the time response analysis, PID controllers and investigate the stability of the system in time domain.
CO4	**Use** frequency response analysis to investigate the stability of the system in frequency domain.
CO5	**Analyze** linear control system using the state space technique.

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	3	3		1						3	3	1
CO2	3	3	3	3		1						3	3	1
CO3	3	3	3	3		1			1			3	3	1
CO4	3	3	3	3		1						3	3	1
CO5	3	3	3	3		1						3	3	2

Syllabus		
Unit No.	Contents	Mapped CO
I	**Introduction:** Classification of control systems, open loop and closed loop control systems and their differences, Feedback characteristics, Concept of Transfer function- impulse response. Transfer function of DC servo motor – AC servo motor. Construction and working of synchro transmitter and receiver.	CO1 CO2
II	**Mathematical Modeling of Control Systems:** Finding Transfer functions for electrical networks. Mathematical models – Differential equations of mechanical systems (Translational and Rotational), electrical systems and electrical analogous of mechanical systems. Block diagram representation by signal flow graph – reduction using Mason's gain formula.	CO2
III	**Time Response Analysis & Stability:** Standard test signals, Time response of first and second order systems with step input signal, time domain specifications, steady state error and static error constants. The concept of stability – Routh's stability criterion –limitations of Routh's stability, Root locus concept – construction of root loci (simple problems). P, PI, PD and PID	CO3

	Controllers.	
IV	**Frequency Response Analysis & Stability:** Introduction to frequency domain specifications- correlation between time and frequency responses. Polar Plots- Stability analysis of Nyquist Plots- Bode plots – Phase margin and Gain margin. All pass and minimum phase systems.	CO4
V	**State Space Analysis of LTI Systems:** Concepts of state, state variables and state model, Conversion of state variable model to transfer function model and Transfer function form to state variable form (controllable canonical form), solving the time invariant state equations, State Transition Matrix and it's Properties, concepts of controllability and observability.	CO5

Learning Resources
Text Books
1. Automatic Control Systems– by Farid Golnaraghi and Benjamin C. Kuo – John wiley and son's., 9th edition, 2010. 2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited 2009, Publishers, 5th edition. 3. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
Reference Books
1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th Edition, 2012. 2. Control Systems Engineering. by Norman S.Nise 8th Edition – John Wiley 2019 3. Control Systems Engineering by S.Palani, 2nd edition, Tata Mc Graw Hill Publications, 2009.
e- Resources & other digital material
1. https://nptel.ac.in/courses/107/106/107106081/ 2. https://nptel.ac.in/courses/108/106/108106098/ 3. https://nptel.ac.in/courses/108/102/108102043/

ELECTRICAL DISTRIBUTION SYSTEMS

Course Code	19EE4501A	**Year**	III	**Semester**	I
Course Category	Program Elective - I	**Branch**	EEE	**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** distribution system planning, voltage control and need of power factor improvement
CO2	**Describe** sub-transmission lines, distribution substations, distribution feeders and protection devices.
CO3	**Illustrate** the co-ordination of protective devices and the characteristics of various loads
CO4	**Analyze** the voltage drop & power loss calculations and the effect of capacitors in distribution systems.
CO5	**Determine** relation between load factor and loss factor, rating of distribution substation

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	3	2				1	1		2	3	2
CO2	3	2	2	2					1	1		2	3	2
CO3	3	2	2	2					1	1		2	3	2
CO4	3	2	2	2	2				1	1		2	3	2
CO5	3	2	2	2					1	1		2	3	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Distribution Systems Planning And Load Characteristics:** Introduction, distribution system planning, factors affecting system planning, Coincidence factor, contribution factor, loss factor, Relationship between the load factor and loss factor, Classification of loads (residential, commercial, agricultural and industrial) and their characteristics.	CO1 CO3 CO5
II	**Design of Sub Transmission Lines and Distribution Substations:** Introduction, Sub-transmission systems, distribution substation, sub-station bus schemes, sub-station location, rating of a distribution substation, Substation service area with 'n' primary feeders, comparison of four and six feeder patterns.	CO2 CO5
III	**Design Considerations of Distribution Feeders:** Introduction, Radial type and loop type primary feeders, primary network, primary feeder voltage levels, primary feeder loading, radial feeders with	CO2 CO4

	uniformly distributed load and non-uniformly distributed loads, Basic design practice of the secondary distribution system. Voltage drop and power loss calculations; three phase balanced primary lines, non three phase primary lines.	
IV	**Distribution system protection.** Basic definitions, over current protection devices-fuses, automatic circuit reclosers, automatic line sectionalizers, automatic circuit breakers. Objectives of distribution system protection, co-ordination of protective devices- fuse to fuse co-ordination, recloser to recloser coordination, fuse to circuit breaker, recloser to fuse co-ordination, recloser to circuit breaker co-ordination.	CO2 CO3
V	**Power Factor Improvement and Voltage Control** Power capacitors, shunt and series capacitors, effect of series and shunt capacitors (fixed and switched), power factor correction, economic justification of capacitors, procedure to determine the best capacitor location. voltage regulators, effect of AVB/AVR, line drop compensation.	CO1 CO4

Learning Resources

Text Books

1. Electric Power Distribution system Engineering by Turan Gonen, CRC press, 3rd edition, 2014.
2. Electric Power Distribution by A.S.Pabla, Tata Mc Graw-hill Publishing Company,6th edition,2011.

Reference Books

1. Electrical Power Distribution and Automation by S.Sivanagaraju,V.Sankar,Dhanpat Rai&Co, 2014
2. Electrical Power Distribution Systems by V.Kamaraju, Overseas Publishers,Hyderabad, 3rd edition, 2008

ELECTRICAL MEASUREMENTS

Course Code	19EE4501B	Year	III	Semester	I
Course Category	Program Elective - I	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Basics of Electrical Engineering
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	**Measure** electrical quantities using various measuring instruments
CO2	**Understand** the concepts of instrument transformers
CO3	**Measure** electrical parameters using DC and AC bridges
CO4	**Analyze** transducers and digital meter for measuring physical and electrical quantities

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			3							3	2
CO2	2		2			2							2	2
CO3	2		2			1							2	2
CO4	2		2			2							2	2

Syllabus

Unit No.	Contents	Mapped CO
I	Classification, deflecting, control and damping torques, Ammeters and Voltmeters, PMMC, moving iron type instruments, Extension of range using shunt and series resistance,Single phase dynamometer wattmeter, LPF and UPF, expression for deflecting torque and control torque, Single phase induction type energy meter, driving and braking torques, errors and compensations.	CO1
II	Current Transformers, theory, ratio error and phase angle error, reduction of errors, construction of C.T, effect of Secondary open circuit, permanent magnetization and demagnetization of cores. Potential Transformers - Theory, ratio error and phase angle error, Reduction of errors, Construction of P.T	CO2
III	Type of P.F meters-Single phase Electrodynamometer Power Factor meter-three phase Electrodynamometer .Power Factor meter and Moving Iron Power Factor meters. Type of Frequency meters – Mechanical Resonance type Frequency meter, Electrical Resonance type Frequency meter-Weston type Frequency meter-Ratio meter type Frequency meter, Saturable core Frequency meter.	CO1
IV	Method of measuring low, medium and high resistances, Wheat stone's bridge, Kelvin's double bridge for measuring low resistance, loss of charge method for measurement of high resistance, Megger. Measurement of	CO3

	inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Measurement of capacitance, Desauty's Bridge, Schering Bridge.	
V	Classification of transducers, Resistive transducer, Strain Gauge, Thermistors, Thermo couples and Linear Variable Differential Transformers. Digital Voltmeters-Successive approximation, ramp and integrating type DVM, Digital frequency meter, and Digital energy meter.	CO4

Learning Resources

Text Books

1. A course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co. Publications.
2. Electrical Measurements and measuring Instruments, E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing company.

Reference Books

1. Electrical Measurements: Fundamentals, Concepts, Applications, Martin. U. Reissland, New Age International Publishers Limited.
2. Electrical and Electronic Measurements, G.K.Banerjee, PHI Learning Private Ltd.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/105/108105153/

FUZZY CONTROL SYSTEM DESIGN AND ANALYSIS

Course Code	19EE4501C	**Year**	III	**Semester**	I
Course Category	Program Elective-I	**Branch**	EEE	**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 basic concepts of Neural Networks and Fuzzy logic
CO2	Develop Neural Network based control system for engineering applications
CO3	Develop Fuzzy logic-based control system for engineering applications
CO4	Develop hybrid neuro-fuzzy architecture for engineering optimization problems
CO5	Apply Machine and deep learning algorithms to solve real-world Engineering problems

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		3								3	
CO2			2		3						3	3		
CO3					3								1	
CO4	2			3										2
CO5			3	3	3							3	1	2

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to fuzzy logic and neural networks:** Classification , Merits and demerits of intelligent techniques compared to conventional techniques. Need of an intelligent technique for real world Engineering applications.	**CO1**
II	**Supervised and Unsupervised Neural networks:** Perception, Standard back propagation Neural network: Architecture, Algorithm and other issues. Discrete Hopfield's networks, Kohnen's self-organizing maps, adaptive resonance theory (ART1).	**CO2**
III	**Fuzzy set and operations :** Fuzzy relations, Fuzzifications, Fuzzy rule-based systems, defuzzification fuzzy learning algorithms.	**CO3**
IV	**Fuzzy logic for control system with case studies:** Introduction to neuro-fuzzy system and genetic algorithm.	**CO4**

V	**Machine learning & Deep learning :** Learning from agents - inductive learning - Types of Machine learning - Supervised learning - learning decision trees - support vector machines. Deep Networks ,Deep Feed forward Networks - Learning XOR - Gradient Based learning - Hidden Units - Back-propagation and other Differential Algorithms - Regularization for Deep Learning - Optimization for training Deep Models.	**CO5**

Learning Resources
Text Books:
1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, John Wiley & Sons Ltd Publications, 4th edition, 2016.
Reference Books:
1. S. Haykin, Neural Networks: A comprehensive Foundation, Prentice Hall Inc., New Jersey, 2nd Edition, 1999. 2. Klir G.J and Folger T.A, Fuzzy sets, Uncertainty and Information, Prentice Hall, New Delhi, 1994. 3. Zdenko Kovacic, Stjepan Bogdan, Fuzzy Controller Design Theory and Applications, CRC Press, 1st edition, 2006. 4. Satish Kumar, Neural Networks–A classroom approach, Tata McGraw-Hill Publishing Company Limited, 2013.. 5. Laurene Fausett, Fundamentals of Neural networks, Pearson education, Eight Impression, 2012. 6. Tom Mitchell, "Machine Learning", McGraw Hill, 1997. 2. E. Alpaydin, "Introduction to Machine Learning", Second Edition, Prentice-Hall of India, 201. 7. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", The MIT Press, 2016
Learning Resources: 1. **http://www.nptelvideos.in/2012/11/intelligent-systems-and-control.html**

ELECTRICAL MACHINES - II

Course Code	19EE3502	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Electrical Machines-I (19EE3401) Basic Electrical and Electronics Engineering (19ES1101)
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 construction, working principle and characteristics of differenttypes of three phase induction motors and solve the problems for various parameters. (L2, L3)
CO2	Understand starting methods, speed control and testing of three phase induction motor.(L2,L3)
CO3	Understand the constructional details of synchronous machines, their load characteristics, solve the problems on regulation and parallel operation of alternator (L2, L3)
CO4	Understand the working principle ,methods of starting and applications of synchronous motor (L2, L3)
CO5	Understand double field theory, construction of single- phase induction motor, special electrical machines and their characteristics and industrial applications. (L2, 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			1		2		1				2	3	2
CO2	2			1		1		1				2	3	2
CO3	3			1		2		1				2	3	
CO4	3			1		2		1				2	3	2
CO5	3			1		1		1				2	3	

Syllabus		
Unit No.	Contents	Mapped CO
I	**Three phase Induction motors:** Concept of rotating magnetic field. Principle of operation, Constructional details of squirrel-cage &slip-ring rotor machines. Slip, torque-slip characteristics covering motoring, generating and braking regions of operation, maximum torque. Phasor diagram of induction motor on no-load and on load. Equivalent circuit.	CO1
II	**Testing of three-phase Induction Motor:** Losses in three phase induction motor efficiency, no-load and blocked rotor tests. Circle diagram and performance evaluation of motor. cogging and crawling. Direct on line (DOL), star-delta and autotransformer starting, rotor resistance starting. **Speed Control of Three-phase Induction Motors:** Speed control-voltage, frequency, and rotor resistance, pole changing and cascading of motors, introduction	CO2

	to solid state controllers.	
III	**Synchronous Generator** Constructional Features of round rotor and salient pole machines, distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation - harmonics in generated e.m.f. – suppression of harmonics, phasor diagrams. Regulation of alternators on load, experimental determination of synchronous impedance - regulation by synchronous impedance method, M.M.F. method and Z.P.F. method. Experimental determination of X_d and X_q (Slip test),two reaction theory, regulation of salient pole alternators. Parallel operation of alternators: Synchronizing of alternators with infinite bus bars current practices– synchronizing power torque – parallel operation and load sharing.	CO3
IV	**Synchronous Motors – Principle of Operation** Theory of operation – phasor diagram – variation of current and power factor with excitation – synchronous condenser – mathematical analysis for power developed - excitation and power circles – hunting and its suppression – methods of starting. **Special Electrical Machines** **Principle of Operation –** Stepper Motor – BLDC Motor – Reluctance Motor – Linear Induction Motor – Hysteresis Motor. **(Theoretical Analysis Only)**	CO4
V	**Single Phase Induction Motor** Classification of single phase induction motors – double revolving field theory – working principle of single winding single phase induction motor – cross field theory – equivalent circuit – power developed – construction, working principle – speed torque characteristics - spilt phase capacitor start motor, capacitor start capacitor run motor - shaded pole motor, ratings and their applications – equivalent circuit – testing of motors – efficiency – no load and blocked rotor tests.	CO5

Learning Resources
Text Books
1. Electrical Machines by PS Bhimbra, Khanna publishers. 2. Electrical Machines by I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishers, 7th Edition 2005. 3. Electrical Machinery by A.E. Fitzgerald, C. Kingsley and S. Umans, Tata Mc Graw Hill Companies, 5th edition 1990. 4. Electrical Machines by J.B.Gupta, Kataria publications.
Reference Books
1. The Performance and Design of A.C.Machines by M.G.Say, ELBS and Pitman & Sons. 2. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw Hill, 2nd edition. 3. Electromachines-III (Synchronous and single phase machines) by S.Kamakashiah, Right Publishers.
e- Resources & other digital material
1. https://nptel.ac.in/courses/108/105/108105131s

Course Code	19CS2501C	**Year**	III	**Semester**	I
Course Category	Inter Disciplinary Elective-I	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

CO1	Understand the basic concepts of database management systems
CO2	Understand normalization techniques with simple examples.
CO3	Apply SQL commands to create tables for a given database application
CO4	Apply ER Model concepts to draw ER Diagrams for a given database application and make an effective report.

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													
CO3	3													
CO4	3								3	3				

Syllabus

Course Content

UNIT-1	**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
UNIT-2	**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
UNIT-3	**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
UNIT-4	**Database Design Theory**: Functional Dependencies, Normal forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form.	CO2

UNIT-5	**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, Mc Graw Hill.

e-Resources and other Digital Material

QUANTITATIVE TECHNIQUES FOR MANAGEMENT

Course Code	19HS2501C	**Year**	III	**Semester**	I
Course Category	Inter Disciplinary Elective-I	**Branch**	EEE	**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
CO2	**Apply** the analytical techniques in business transactions that would help in making effective business decisions
CO3	**Analyze** problems in business transactions that would help in making effective business
CO4	**Apply** the least square technique to find the equation of the curve.
CO5	**Determine** the equation of the curve from the given data.
CO6	**Apply** the various methods to find the deviations and **submit a report**

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	
CO2	3												2	
CO3		3											2	
CO4	3												2	
CO5		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

OOP with C++

Course Code	19IT2501C	**Year**	III	**Semester**	I
Course Category	Inter Disciplinary Elective-I	**Branch**	EEE	**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

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

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	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

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	**CO2,CO4**

	constructors, Constructors with default arguments **Operator Overloading:** Introduction, The keyword operator, Overloading unary operators, Overloading binary operator.	
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
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
http://www.cplusplus.com https://www.w3schools.com/cpp/

COMPUTATIONAL METHODS

Course Code	19IT2501C	**Year**	III	**Semester**	I
Course Category	Inter Disciplinary Elective-I	**Branch**	EEE	**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

Upon Successful completion of 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)													
	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	

UNIT No.	Contents	Mapped COs
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	CO5

	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.	

Learning Recourse(s)
Text Book(s)
1. StevenC.Chapra,RaymondP.Canale"NumericalMethodsforEngineers"TataMc-Grawhill,,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/colepublishingcompany1999,fourthedition. 2. Riley K.F.M.P.Hobson &BenceS.J," mathematical methods for physics and engineering" Cambridgeuniversitypress,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/

BIOTECHNOLOGY AND SOCIETY

Course Code	19ES5501A	**Year**	III	**Semester**	I
Course Category	Open Elective-I	**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	Understanding the basic concepts of advanced and emerging issues in biotechnology
CO2	Analyze, and evaluate social and ethical issues in the conduct of biological research and application of biological knowledge
CO3	Apply knowledge and analytical approaches in several major domains of the biological sciences that reflects a breadth and depth of understanding
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
CO5	Apply responsibilities to promote societal health and safety, upholding the trust given to the profession by the society

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							

UNIT NO	**Contents**	**Mapped COS**
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, Bioprospecting and Biocolonialism	CO3 CO4
V	Vaccines, Gene therapy, Clinical trials, Synthetic Biology and Bioterrorism, Use of biofertilisers and biopesticides for organic farming	CO4 CO5

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

ELECTRICAL SAFETY

Course Code	19ES5501B	**Year**	III	**Semester**	I
Course Category	Open Elective I	**Branch**	EEE	**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 must 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.
CO2	**Outline** the electrical safety during installation, testing and commissioning procedure.
CO3	**Make use of** specification of electrical plants and classification of safety equipment for various hazardous locations.
CO4	**Distinguish** various fire extinguishers and their classification.

Contribution of Course Outcomes towards achievement of Program Outcomes &Program Specific Outcomes. Strength of Correlation between CO – PO, CO- PSO in scale of 1-3

1: Slight (low), 2: Moderate (medium) 3: Substantial (High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**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

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction To Electrical Safety, Shocks And Their Prevention:** Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shop.	**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	**CO1**

	use of domestic electrical appliances.	
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, equipment's 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;$CO_2$and Halogen gas schemes; foam schemes.	**CO1 CO4**

Total Periods: 45, 9 periods for each unit.

Learning Resources
Text Books:
1. Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1988.
Reference Books:
1. Cooper.W.F, "Electrical safety Engineering", Newnes-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.

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 En Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
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.
CO2	Demonstrate the basic concepts of Cognizable and Non-Cognizable Offences, Hacking, Teenage Web Vandals, Prevalence and Victimology, Consumer Protection Act.
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.
CO4	Explain the concepts of Arrest, But No Punishment, Cyber Cheating, Theft of Intellectual Property, Restrictive and Unfair Trade practices

Contribution of Course Outcomes towards achievement of Program Outcomes &Program Specific Outcomes._Strength of Correlation between CO – PO, CO- PSO in scale of 1-3

1: Slight (low), 2: Moderate (medium) 3: Substantial (High)

	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

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, 2 nd Edition,PHI,2003.
2. Justice Yatindra Singh, " Cyber Laws", Universal Law Publishing, 1 st 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

ENVIRONMENT AND 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**	19MC1301 – Environmental Science
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 develop an awareness, knowledge, and appreciation for the natural environment.
CO2	To determining different types of conventional sources, exist in nature.
CO3	To articulate the environmental pollution and their effects.
CO4	To distinguishing the different laws on environmental protection.
CO5	To know the global environmental problems.

Contribution of Course Outcomes towards achievement of Program Outcomes &Program Specific Outcomes._Strength of Correlation between CO – PO, CO- PSO in scale of 1-3

1: Slight (low), 2: Moderate (medium) 3: Substantial (High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3					2	3	1	2			3	3	
CO2	3					2	3	1	2			3	3	
CO3	3					2	3	1	2			3	3	
CO4	3					2	3	1	2			3	3	
CO5	3					2	3	1	2			3	3	

Course Content		
UNIT-1	Definition, Scope & Importance, Need For Public Awareness- Environment Definition, Ecosystem Human Activities – Food, Shelter, Economic and Social Security. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development.	CO1
UNIT-2	Natural Resources- Water Resources- Availability and Quality aspects. Water borne diseases, Water induced diseases, Fluoride problem in drinking water. Mineral Resources, Forest Wealth, Carbon Cycles, Oxygen cycles, Nitrogen Cycles. Energy – Different types of energy, Conventional and Non-Conventional sources – Hydro Electric, Fossil Fuel based Nuclear, Solar, Biomass and Biogas.	CO2.
UNIT-3	Environmental Pollution and their effects. Water pollution, Land pollution. Noise Pollution, Public Health Aspects, Air Pollution, Deforestation, Major Causes of Deforestation and consequences of deforestation, Solid Waste Management. Current Environmental Issues of Importance: Population Growth, Climate Change	CO3

	and Global warming-Effects, Urbanization, Automobile pollution. Ozone Layer depletion, Acid Rain, impact of Acid rain.	
UNIT-4	Environmental Protection- Role of Government, Air Act, Water Act, Wild life Act, Environmental Act. Initiatives by Non-governmental Organizations, (NGO), Environmental Education, Women Education.	CO4
UNIT-5	Evidence of Global warming, consequences of climatic change, consequences of climate change in India. Biodiversity and Legislation, Earth Summit, the Montréal protocol, Kyoto protocol on climatic change.	CO5

Learning Resources

Text Books	1. Text book of Environmental Science & Technology – M. Anji Reddy – BS Publication. 2. S. V. S. Rana, Essentials of Ecology and Environmental Science, Prentice Hall India, New Delhi, 2011. 3. Environmental Studies – Benny Joseph – Tata Mc Graw Hill-2005
Reference Books	1. Principles of Environmental Science and Engineering – P. Venu 146opalan Rao, Prentice Hall of India. 2. Environmental Science and Engineering – Meenakshi, Prentice Hall India.
e-Resources & other digital material	

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
CO2	Develop a deep insight into the famous epics and cultivate national consciousness
CO3	Apply the knowledge gained to various real life situations
CO4	Analyze the contemporary relevance of Indian epics(L4)
CO5	Interpret and correlate the ideals to one's own life.

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		

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

Text books

1. *Ramayana* by R. K. Narayan (Penguin)
2. *Mahabharata* by R. K. Narayan (Penguin)
3. Geetha darshan by Rama krisha mission

Learning Resources

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

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
CO2	**Specify** major stages of freedom struggle and their ideological distinctions
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					

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Back ground : Early British Colonialism in India, early rebellions –Pazhassi raja(the cotiote war -Kerala, 18 th century), Veerapandiyan Kattabomman (Taminadu/Madras Presedency-18 th century), Paik rebellion (Kalinga/ Odisha, early 19 th century), Vellore mutiny (early 19 th century); The Sepoy Mutiny of 1857 and its consequences.	CO1
II	Contributory Factors: Socio political consciousness, growth of Western education and its impact socio -religious movement, British Economic Policies and their impact .	CO1
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	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	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 Indepedence, 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 NewDelhi,1979.

Reference Books

e- Resources & other digital material

ENGINEERING SERVICES FOR COMMUNITY

Course Code	19HS5501C	**Year**	III	**Semester**	I
Course Category	Open Elective-I	**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.
CO2	Examine the role that engineering might play in the different aspects of sustainability development.
CO3	Solve basic analytical and design problems using engineering tools, and be proficient and efficient in the use of these tools.
CO4	Explore various awareness methods about safety, risk & risk benefit analysis
CO5	Analyze what constitutes social justice in different areas of social life and the role that engineering might play in these.

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	

SYLLABUS		
UNIT NO.	**CONTENT**	Mapped CO
I	**The Engineering Profession** On being a Professional Technical Expertise and Ethical Obligations Organization of Professional Engineering Engineering Codes of Ethics	CO1, CO2, CO5
II	**Engineering and Sustainable Community Development** Understanding Community Engineers' Beliefs about Community Development	CO1, CO2, CO4

	Measuring Sustainability Engineers as Problem Solvers	
III	**Engineers and Development** Engineering Disasters: Lessons to be Learned Technology for Community Development Renewable Sources of Energy Green and Smart Cities	CO1, CO3, CO4
IV	**Safety of the Public** Ethical Dilemmas Calculating the Value of Life Whistle blowing Trusting the Experts Case Studies: a. Sinking of the Titanic b. Bhopal Gas Tragedy	CO1, CO3, CO4
V	**Engineering and Social Justice** Social Justice in Engineering Sciences Humanities and Social Sciences in Engineering Education Transforming Engineering Education and Practice 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.

PERSONALITY DEVELOPMENT

Course Code	19HS5501D	**Year**	III	**Semester**	I
Course Category	Open Elective-I	**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 fundamentals of various aspects of personality traits
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		

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 BarunK.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:
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

INDIAN HISTORY

Course Code	19HS5501G	Year	III	Semester	I
Course Category	Open Elective-I	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 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	**Analyze** the impact of British colonial rule on industrialization 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

Course Content		
UNIT-1	**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
UNIT-2	**Medieval Indian History and Culture** – Delhi Sultanate , Great Mughals South Supremacy and Conflicts Pallavas , Cholas, Kakatiyas, Vijayanagara Empires their Contribution to Indian Culture.	CO2
UNIT-3	**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

UNIT-4	**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
UNIT-5	**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	
Reference Books	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	https://onlinecourses.swayam2.ac.in/cec20_hs04/preview	

INTERNET OF THINGS LABORATORY

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
CO2	**Analyze** various Physical Computing Techniques
CO3	**Evaluate** Wireless Control of Remote Devices
CO4	**Design and develop** Mobile Application which can interact with Sensors and Actuators

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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	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

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	Digital I/O Interface - Multicolour Led, IR Sensor, PIR, Slot Sensor.	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 Wifi.	CO3
VIII	Wireless Control of wheeled Robot using Bluetooth/Wifi.	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.

ELECTRICAL MACHINES-II LAB

Course Code	19EE3551	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisite**	Electrical Machines-I Lab (19EE3451) Basic Electrical and Electronics Engineering Lab (19ES1151)
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 performance of three phase and single phase induction motor.
CO2	**Analyze** the performance of the alternator and predetermine the regulation.
CO3	**Classify** the 'V' & ' Λ ' curves of synchronous motor
CO4	**Obtain** the synchronous machine parameters and understand the performance of special machines such as three phase schrage motor

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			2			2	3	2
CO2	3		2			1			2			2	3	2
CO3	3		2			1			2			2	3	2
CO4	3		2			1			2			2	3	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
1.	Brake test on three phase Induction Motor	CO1
2.	No–load & Blocked rotor tests on three phase squirrel cage induction motor	CO1
3.	Equivalent circuit of a three phase induction motor and measurement of slip power.	CO1
4.	Equivalent circuit of a single phase induction motor	CO1
5.	Brake test on single phase induction motor	CO1
6.	Regulation of a three-phase alternator by synchronous impedance method	CO2
7.	Regulation of a three-phase alternator by mmf method.	CO2
8.	Regulation of a three-phase alternator by Z.P.F. method	CO2
9.	Measurement of sequence impedance of a three-phase alternator	CO2
10.	' V ' & 'Λ ' curves of a three-phase synchronous motor.	CO3
11.	Determination of Xd and Xq of a salient pole synchronous machine	CO4

12.	Brake test on three phase Schrage motor.	CO4
13.	Determination of performance of induction generator	CO1

Learning Resources

Text Books

1. Dr.P. S Bimbhra-Electrical Machinery-7/e -Khanna Publishers,2018.
2. I.J. Nagarath and D.P. Kothari, ―Electric Machines, 4/e, McGraw Hill,2010.
3. A.E. Fitzgerald, Charles Kingsley Jr. Stephen D. Umans, ‒Electric Machinery 7/e, McGraw,Hill.,2013

CONTROL SYSTEMS ENGINEERING LAB

Course Code	19EE3552	**Year**	III	**Semester**	I
Course Category	Program Core	**Branch**	EEE	**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** the performance characteristics and working of Magnetic amplifier, DC & AC servo motors and synchros.
CO2	**Determine** the transfer functions of DC Motor and DC generator and acquire compensating networks
CO3	**Demonstrate** the time response analysis and performance of PID controllers
CO4	**Compute/Operate** programmes in MATLAB software and PLC programming which will help them in doing their projects. **(L2 & 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	1
CO2	3	3											3	1
CO3	3	3	3	2		1							3	1
CO4	3	3		3	3							2	3	2

Syllabus		
Expt. No.	Contents	Mapped CO
PART-A (Any Eight Experiments)		
1	Time response of Second order system	CO3
2	Characteristics of Synchros	CO1
3	Effect of P, PD, PI, PID Controller on a second order systems	CO3
4	Transfer function of DC motor	CO2
5	Temperature controller using PID	CO3
6	Characteristics of magnetic amplifiers	CO1
7	Programmable logic controller – Study and verification of truth tables of logic gates	CO4
8	Characteristics of AC servo motor	CO1
9	Characteristics of DC servo motor	CO1
10	Transfer function of DC generator	CO2
11	Lag and lead compensation – Magnitude and phase plot	CO2
PART-B (Any Two Experiments)		
1	Bode Plot, Root locus, Nyquist Plots for the transfer functions of systems using	CO4

	MATLAB.	CO2
2	Controllability and Observability test using MAT LAB.	CO4
3	State space model for classical transfer function and vice versa using MATLAB – Verification.	CO4
4	Stability of a mechanical translating system using MATLAB Simulink.	CO4
5	Block diagram representation of field controlled DC servo Motor using MATLAB Simulink.	CO4
6	Time response of first order systems for standard test signals using MATLAB	CO4 CO3

Learning Resources

Text Books

1. Control Systems by Nagoor Kani, RBA Publications, 2nd edition 2017.
2. MATLAB and its Tool Books user's manual and – Mathworks, USA.
3. Programmable Logic Controllers-Programming Method and Applications –JR.Hackworth & F.DHackworth Jr. –Pearson, 2004

ENGINEERING ECONOMICS AND MANAGEMENT

Course Code	19HS1601	**Year**	III	**Semester**	II
Course Category	HS	**Branch**	EEE	**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 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	

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

Text 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.

Reference Books

e- Resources & other digital material

POWER SYSTEMS-I

Course Code	19EE3601	**Year**	III	**Semester**	II
Course Category	Program core	**Branch**	EEE	**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	Understand the layout and working of various power plants, types of transmission lines and tariff
CO2	Estimate the transmission line parameters, mechanical design parameters of overhead lines.
CO3	Analyse the performance of transmission lines and Economic Aspects of power system
CO4	Demonstrate the effect of corona and importance of load sharing

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													
CO2	2	3											1	1
CO3	2	3			1								1	1
CO4	2												1	

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Conventional and Non-conventional power Generation** Introduction - General layout of thermal power plant, working and site selection - General layout of nuclear power plant, working and site selection - General layout and working of hydroelectric power plant, site selection, pumped storage plants - Comparison of thermal and hydel power plants. Introduction to Non-Conventional Sources (elementary treatment only): Solar Energy, wind Energy.	CO1
II	**Transmission line Parameters** Overhead Transmission Lines: Resistance, Capacitance and Inductance calculations for single phase two wire line, three phase line with symmetrical spacing for single circuit line, proximity effect and skin effect – numerical problems	CO1 & CO2
III	**Performance of transmission lines:** Classification of Transmission Lines -Short, medium and long lines, Medium lines- Nominal-T, Nominal-Π methods, Long lines-rigorous methods of solution, ABCD constants, regulation, efficiency, Ferranti effect, Surge Impedance loading - numerical problems	CO3

IV	**Mechanical design of over headlines** Types of insulators, voltage distribution in suspension-type insulators, String efficiency, Methods of improving string efficiency, tension and sag calculation, effects of wind and ice loading - numerical problems Corona: Formation of corona, Critical voltages, Power loss and factors affecting corona, Merits and Demerits.	CO2 & CO4
V	**Economic Aspects and Tariffs** Load curve, load duration curve, definition: connected load, average load, maximum demand, load factor, demand factor, diversity factor, plant capacity factor, plant use factor- numerical problems. Tariffs: Base load and peak load stations, load sharing between base load and peak load stations - objectives of tariff, factors affecting tariff, types of tariffs block and stepped tariff – two-part tariff and three-part tariff – Frequency dependent tariff- unscheduled interchange-based tariff, Numerical problems	CO1, CO3 & CO4

Learning Resources
Text Books:
1. A course in Electrical Power systems, J.B. Gupta – 11th edition - Kataria Publications. 2. Electric power generation, transmission and distribution, S. N. Singh, 2nd edition- PHI Learning 3. Principles of Power Systems, V.K Mehta and Rohit Mehta - S.Chand & Company ltd.
Reference Books:
1. A Text Book on Power System engineering, R.K.Rajput, Laxmi Publication (P) Ltd. 2. Generation, Distribution and Utilization of Electrical Energy, C.L.Wadhwa, New Age International publishers.

POWER SYSTEM PROTECTION

Course Code	19EE4601A	**Year**	III	**Semester**	II
Course Category	Program Elective	**Branch**	EEE	**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** operation of various switchgear equipment.
CO2	**Identify** different protection schemes adopted in power system.
CO3	**Apply** various relays to protect different electrical equipment.
CO4	**Implement** various grounding practices and insulation coordination in the power system.

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	2			2	2							2	2
CO2	2	2			2	2							2	2
CO3	2	2	2		2	2							2	2
CO4	2	2	2		2	2							2	2

SYLLABUS

Unit No.	**Contents**	**Mapped CO**
I	**Circuit Breakers** Circuit Breakers: Elementary principles of arc interruption, Restriking phenomenon, Restriking voltage and Recovery voltages, average and max. RRRV, numerical problems – Current chopping and resistance switching - CB ratings and specifications, auto reclosures –Numerical Problems. Types of circuit breakers: Minimum oil circuit breakers, Air blast circuit breakers, Vacuum and SF6 circuit breakers.	**CO1**
II	**Fundamentals of Protective Relaying** Need for Protective systems - Nature and causes of Faults -Types of faults - Effect of faults - fault statistics - Evolution of protective relays - Zones of protection – Primary and Back-up Protection - Essential qualities of Protection Principle of operation and construction of attracted armature, balanced beam, induction disc and induction cup relays. Introduction to static relays -phase and magnitude comparators- level detectors. Numerical relays - phase and magnitude comparators- level detectors. Comparison of electromagnetic, static and numerical relays.	**CO2**
III	**Relay Applications** Universal torque equation, over current relay, direction relays, differential relays and percentage differential relays-electromagnetic-static.	**CO3**

	Over Current Relays Classification: Instantaneous, DMT, IDMT types and under voltage relays. Distance relays: impedance, reactance, mho and Off-Set mho relays. Characteristics of distance relays and comparison-Electromagnetic only.	
IV	**Generator, Transformer, Bus bar and Transformer Protection** Protection of generators against stator faults, rotor faults, and abnormal conditions. Restricted earth fault and inter-turn fault protection. Numerical Problems on percentage winding unprotected. Protection of transformers: Percentage differential protection, numerical problem on design of CT's ratio, Buchholtz relay protection. Protection of Lines: Over current, carrier current and three-zone distance relay protection using impedance relays, translay relay. Protection of bus bars – differential protection	**CO3**
V	**Protection Against Over Voltages and Travelling Waves** Grounded and ungrounded neutral systems.- Effects of ungrounded neutral on system performance. Methods of neutral grounding: solid, resistance, reactance - arcing grounds and grounding practices. Protection of transmission lines, Power stations and substations against direct lightning strokes-protection against travelling waves-Insulation coordination.	**CO4**

Learning Resources
Text Books:
1. Switchgear and Protection by Sunil S Rao, Khanna Publlishers 2. Power System Protection and Switchgear by BadariRam, D.N Viswakarma, TMH Publications, 2 nd edition. 3. Switchgear and Protection by J.B.Gupta, S.Chand publications, 2nd edition.
Reference Books:
1 Fundamentals of Power system protection by Paithankar and SRBhide.,PHI, 2003,2nd edition. 2. Electrical power systems – by C.L.Wadhwa, New Age International (P) Limited,4th edition 3. A Text book on Power system engineering by B.L.Soni, Gupta, Bhatnagar, Chakrabarthy, Dhanpat Rai & Co
e-Learning Resources: https://nptel.ac.in/courses/108/107/108107167/

INDUSTRIAL ELECTRICAL SYSTEMS

Course Code	19EE4601B	**Year**	III	**Semester**	II
Course Category	Program Elective	**Branch**	EEE	**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 advantages and utilization of electrical systems in industries to meet societal needs.
CO2	**Identify** a suitable motor for electric drives and industrial applications.
CO3	**Identify** most appropriate heating or welding techniques for suitable applications.
CO4	**Design** Illumination systems for various applications.
CO5	**Employ** mathematical analysis considering different practical issues to design of traction system; analyze the performance parameter of the traction system.

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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1														
CO2	2												2	2
CO3	2												2	
CO4	2					2							2	2
CO5		2											2	2

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Electric Drives** Type of electric drive, choice of motor, starting and running characteristics, speed control, selecting motor power rating for continuous, intermittent and short time rating duty, heating and cooling of motors, temperature rise, particular applications of electric drives, types of industrial loads.	**CO1 CO2**
II	**Electric Heating & Electric Welding** Advantages and methods of electric heating, methods of heat transfer, Stefan's law, design of heating elements, resistance heating, construction and working principle of induction furnaces, arc furnaces and dielectric heating. Types of welding, resistance and arc welding, comparison between A.C and D.C Welding.	**CO1 CO3**

III	**Illumination** Introduction, Terms used in illumination, laws of illumination, sources of light. Incandescent lamps, Discharge lamps, MV and SV lamps, fluorescent lamps- CFL-LED lamps, Types of lighting schemes, factory lighting, flood lighting and street lighting.	**CO1** **CO4**
IV	**Electric Traction-I** Systems of electric traction and systems of track electrification, special features of traction motors, methods of electric braking-plugging, rheostat braking and regenerative braking, Speed-time curves for different services-trapezoidal and quadrilateral speed time curves.	**CO1** **CO5**
V	**Electric Traction-II** Mechanics of train movement, Calculations of tractive efforts and power output of traction motor, Specific energy consumption for given run, effect of varying acceleration and breaking retardation, adhesive weight and braking retardation and coefficient of adhesion. OHE in traction system, collectors and modern electric locomotive.	

Learning Resources
Text Books:
1. Utilization of Electrical Energy - by E. Openshaw Taylor, Orient Longman,2003. 2. Art & Science of Utilization of Electrical Energy - by Partab, DhanpatRai& Sons,12th edition,2012. 3. Automobile Engineering by Dr Kirpal Singh , Stadard Publishers and Distributors
Reference Books:
1. Utilization of Electrical Power including Electric drives and Electric traction – byJ.B.Gupta, S.K. Kataria & Sons, . 2. Generation, Distribution and Utilization of Electrical Energy – by C.L.Wadhwa New Age international (P) Limited,Publishers,1997

MODERN CONTROL THEORY

Course Code	19EE4601C	**Year**	III	**Semester**	II
Course Category	Program Elective	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Control 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	**Classify** PID controllers and feedback control in different modes.
CO2	**Distinguish** Lag, Lead, Lag-Lead compensators and design to improve system performance from bode diagrams and rootlocus.
CO3	**Analyze** linear control system using the state space technique.
CO4	**Construct** controller design, observability and controllability
CO5	**Illustrate** the theory of z–transformations and application for the mathematical analysis of discrete time 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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3		1			1			2	3	2
CO2	3	3	3	3		1			1			2	3	2
CO3	3	3	3	3		1			1			2	3	2
CO4	3	3	3	3		1			1			2	3	2
CO5	3	3	2	2		1						2	3	2

Syllabus		
Unit No.	Contents	Mapped CO
I	**Controllers:** Introduction to Block diagram of on-off control, proportional control, integral control, derivative control, PI, PD and PID control. Control objective, feedback control systems characteristics, proportional mode of feedback control, integral mode of feedback control, derivative mode of feedback control.	CO1
II	**Classical Control Design Techniques:** Lag, lead, lag-lead compensators, design of compensators using Bode plots and design of compensators using Root locus.	CO2
III	**State Space Analysis of Continuous time Control Systems:** State diagram, state transition matrix, conversion of state variable models to transfer function. Conversion of transfer functions to canonical state variable models. Solution of state variable models, state transmission matrix, solution of state equations.	CO3
IV	**Design of state feedback controller:** Introduction, controller design by pole placement, definition of observability and controllability.	CO4

V	**Discrete time systems:** Introduction to discrete time systems, analog and digital controllers, the z transformation, basic definition of z-transform, Difference equation and its solution by the z-transform method. Initial value and Final value theorems. Inverse z-transform by expanding X(z) into (i) an infinite power series and (ii) partial fractions. Pulse transfer functions, pulse transfer function of closed loop system using signal flow graph technique.	CO5

Learning Resources
Text Books
1. M.Gopal, Control Systems Principles and Design Engineering, 2/e, Tata McGraw Hill, 2007. 2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited 2009, Publishers, 5th edition. 3. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
Reference Books
1. Katsuhiko Ogata, Modern Control Engineering, 5/e, Prentice Hall of India,2010. 2. M. Gopal, Digital Control and State Variable Methods, 4/e, McGrawHill, 2012.

MICROPROCESSORS AND MICROCONTROLLERS

Course Code	19EE3602	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Digital 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	Have a clear understanding of the architecture and instruction set of 8086 and 8051.(L2)
CO2	Develop 8086 and 8051 assembly language programs to perform a given task.(L3)
CO3	Interface peripherals and memories with 8086 and 8051.(L4)
CO4	Design real-time application of Microprocessors and Microcontrollers.(L6)

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												1	
CO2	3	2		3	2								2	
CO3	3	3	2	2	3								3	
CO4	3	3	3	3	3								3	3

Syllabus

Unit No.	**Contents**	**Mapped CO**
I	**Intel8086** Introduction and evolution of Microprocessors, Architecture of 8086, Register Organization of 8086, Memory Organization of 8086, Pin diagram of 8086. Minimum and Maximum mode operations of 8086, General Bus Operation of 8086, Read and Write cycle timing diagram.	CO1
II	**ASSEMBLY LANGUAGE PROGRAMMING** Addressing Modes and Instruction set, Assembler Directives, Procedures and Macros, simple assembly language programming.	CO1, CO2
III	**Basic Peripherals and Interfacing** Static Memory interfacing with 8086, 8255 PPI, Architecture of 8255 PPI, Various modes of operations and interface of I/O devices to 8086 using 8255, Interfacing A/D, D/A Converter, Stepper motor interface. Programmable DMA Controller 8257, Programmable Interrupt Controller 8259, Serial Communication Interface USART 8251.	CO3, CO4
IV	**8051 Microcontrollers** Intel 8051 architecture, memory organization, flags, stack, and special function registers, I/O ports counters and timers, serial data I/O, interrupts. Addressing modes, instructions set, Simple assembly language Programming.	CO1, CO2
V	**Interfacing and Applications of 8051** Interfacing external memory, Interfacing 8051 to LED's, Relay's and Latch	CO3, CO4

	Connections, interfacing seven segment display, ADC and DAC interfacing, Stepper motor control.	

Learning Resources

Text Books

1. Douglas V. Hall, "Microprocessors and Interfacing", TMH-Revised 2nd edition,2006.
2. A. K. Ray and K. M. Burchandi, "Advanced Microprocessors and interfacing", Tata McGraw Hill, 2nd edition, 2006.
3. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition, 2004

Reference Books

1. Ajay V. Deshmukh, "Microcontrollers – Theory & Applications", Tata McGraw Hill, 2005.
2. M.A. Mazidi, R.D. McKinlay, J.G. Mazidi, "The 8051 Microcontroller: A Systems Approach", Pearson, 2013.
3. Kenneth J Ayala, "The 8086 Microprocessors Architecture, Programming and Interfacing the PC", West Publishers, 1995.

e- Resources & other digital material

1. **https://nptel.ac.in/courses/108/103/108103157/**
2. **https://nptel.ac.in/courses/108/107/108107029/ (Web Content)**
3. **https://nptel.ac.in/courses/108/105/108105102/**

ELECTRICAL MACHINE DESIGN

Course Code	19EE4602A	**Year**	III	**Semester**	II
Course Category	Program Elective-III	**Branch**	E.E.E	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Electrical Machines – I &II
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 the material used for construction of Electrical machines (L1)
CO2	**Apply** the basic concepts of magnetic, Electric and Heating circuits for design of electric machines.
CO3	**Analyze** the concepts of construction and performance of transformers.
CO4	**Analyze** the concepts of construction and performance of rotating machines.

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							3	
CO2	3	2			1	1							3	
CO3	3	2	2		1	1		2			2		3	2
CO4	3	2	2		1	1		2			2		3	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Fundamental Aspects of Electrical Machine Design** Design of machines - design factors - limitation in design - modern trends in electrical machine design – types of magnetic, electric and insulating materials – modes of heat dissipation – cooling of rotating machines – methods of cooling.	CO1
II	**Design of transformers** Transformer windings – output equation – design of main dimensions-– design of core - choice of flux density – determination of number of turns and length of mean term - resistance and leakage reactance – no load current calculation –cooling of transformers- calculation of number of tubes.	CO2,3
III	**Design of DC Machines** Output equation –selection of specific magnetic and electric loadings - separation of D and L – estimation of number of conductors, armature slots and conduct dimensions – choice of number of poles and calculation of length of airgap – design of field systems, interpoles and brushes.	CO2,4
IV	**Design of Induction motors** output equation -main dimensions – choice of average flux density and ampere conduction for meter — design of stator slots and rotor slots- design	CO2,4

	of rotor bars end rings– design of wound rotor – design of no load current.	
V	**Design of Synchronous Machines** Types of construction – output equation - main dimensions – short circuit ration and its effects on the performance –design of rotor –Design of field winding – Design of turbo alternators – Rotor design temperature rise and its effects.	CO2,4

Learning Resources

Text Books

1. "Electrical Machines Design" ,A.K.Sawhney, Dhanpath Rai & Co.

Reference Books

1. "Performance and Design of DC Machines", Clayton & Hancock, ELBS.
2. "Performance and Design of AC Machines", M.G.Say; Pitman, ELBS.

e- Resources & other digital material

ELECTRICAL DRIVES

Course Code	19EE4602B	**Year**	III	**Semester**	II
Course Category	Program Elective-III	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisite**	Power Electronics (19EE3301)
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	Discuss electric drive system and multi quadrant operation
CO2	Examine the 1Φ, 3Φ rectifiers fed DC motor drive system
CO3	Examine the Chopper fed DC motor drive system
CO4	Analyze and Develop the Inverter fed induction motor drive system
CO5	Review the drive system for the recent applications

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	2		3							3	3	2
CO2	3	2	3		3							3	3	2
CO3	3	2	3		3							3	3	2
CO4	3	2	3		3							3	3	2
CO5	3	2	3		3							3	3	2

Syllabus

Unit No.	Contents	Mapped CO
I	**Fundamentals of Electric Drives** Introduction of Electric drives and various parts, Classification of Electrical Drives, choice of electric drives and selection of drives for various applications; fundamental torque equation, multi-quadrant operation of a motor driving hoist, Equivalent values of Drive Parameters.	CO 1
II	**DC Drives by Phase converters** Controlled rectifier fed dc drives, single phase half controlled rectifier control, single phase fully controlled rectifier control of dc separately excited motor, rectifier control of dc series motor. Three phase half controlled rectifier control, Three phase fully controlled rectifier control of dc separately excited motor, multi quadrant operation of separately excited motor fed from fully controlled rectifier. Numerical problems.	CO 2
III	**DC Drives by Choppers** Introduction to chopper fed four quadrant operation, types of braking, Control of chopper fed dc separately excited, series motor and speed-torque	CO 3

	characteristics. Converter ratings and closed loop control.	
IV	**AC Drives** Stator voltage control, variable frequency control from voltage sources, VSI fed induction motor drives, Current Source Inverter Control, rotor resistance control, slip power recovery schemes-static scherbius, static Kramer drive. Linear transformation from three phases to two phases and vice versa, Introduction to Vector control (Block Diagram only).	CO 4
V	**Essential Applications of Electrical Drives** Solar powered Pump Drives, Battery Powered Electrical Vehicles, Drive requirements for machine tools, Brushless DC motor drive for Servo Applications. AC Traction using converter controlled dc Motors and DC Traction Using Chopper controlled dc Motors.	CO 5

Learning Resources
Text Books
1. Fundamentals of Electric Drives by G K Dubey ,Narosa Publications.2011 2. R.Krishnan, Electric Motor & Drives: Modelling, Analysis and Control, Prentice Hall of India, 2001. 3. Vedam Subramanyam, Electric Drives Concepts and Applications, second edition, Tata McGraw Hill Education Private Limited,2011.
Reference Books
1. G.K. Dubey, Power Semiconductor Controlled Drives, Alpha Science International Ltd. 2001. 2. Bimal K. Bose, Modern Power Electronics and AC Drives, Prentice-hall of India Pvt. Ltd, 2005. 3. P.S. Bhimbra,'Power Electronics',5th edition, KhannaPublications 4. Ned Mohan, Tore M. Undeland, and William P. Robbins, "Power Electronics Converters Applications and Design", 3rd edition, McGraw-Hill Education.
e- Resources & other digital material
1. https://nptel.ac.in/courses/108/104/108104140/

SMART GRID

Course Code	19EE4602C	Year	III	Semester	II
Course Category	Program Elective-III	Branch	EEE	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 concepts of smart grid.
CO2	**Discuss** on smart metering infrastructure
CO3	**Use** Load flow and contingency methods for smart grid.
CO4	**Employ** stability assessment tools for smart grid.
CO5	**Know** how a smart grid can be used to meet the needs of a utility(L5)
CO6	**Create** a frame work for knowledgeable power engineers to operate the grid more effectively.

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						3	3
CO2	3		3		3	3	3						3	3
CO3	3	3											3	3
CO4	3	3											3	3
CO5	3				3	3	3						3	3
CO6	3			3		3	3					3	3	3

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Smart Grid :** Smart grid Definition, benefits, Comparison of Traditional Grid and Smart Grid, Stakeholders in smart grid development, functions of smart grid components, Computation intelligence, Comparison between micro grid and smart grid.	**CO1, CO5**
II	**Communication and Measurement:** Introduction, wide area monitoring system, phasor measurement unit, Comparison of Conventional and smart metering, Benefits of smart meters, Functional block diagram of a smart meter architecture, advanced metering infrastructure, GIS technology, MAS technology.	**CO1, CO2, CO5, CO6**
III	**Performance Analysis Tools For Smart Grid Design:** Introduction to Load Flow Studies, Challenges to Load Flow in Smart Grid , load flow state, congestion management effect, Contingencies and their Classification , Contingency Studies for the Smart Grid, steady state contingency analysis, performance indices, sensitivity based approaches.	**CO1, CO3, CO6**

IV	**Stability Analysis for Smart Grid** Introduction to stability, voltage stability assessment types, voltage stability assessment technique, voltage stability indexing, analysis techniques.	**CO1, CO4, CO6**
V	**Computational Tools for Smart Grid** Introduction, decision support tools, optimization techniques, classical optimization techniques, linear programming, non linear programming, integer programming, dynamic programming, stochastic programming, chance constant programming.	**CO1, CO6**

Learning Resources
Text Books:
1. Smart Grid – Fundamentals of design and analysis by James Mamoh, Wiley – IEEE press
Reference Books:
1. Smart Grid Technology and Application by Janaka Ekanakye, Kithsiri Liyanage, Jianzhang Wu, Akiihiko Yokoyama and Nick Jeenkins , Wiley publications

POWER ELECTRONICS

Course Code	19EE3603	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisite**	ECA (19EE3301) & ED and AC (19EE3302)
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 operation of various power electronic devices and their characteristics, firing scheme, Snubber circuit, series and parallel connections of SCR. (L1)
CO2	Analyze the operation of Rectifiers and Choppers for R, RL Loads.
CO3	Analyze the operation of Inverters and AC to AC converters for R, RL Loads.(L4)
CO4	Apply the operation to derive the load voltage and current expressions for Rectifiers, Choppers, Inverters and AC to AC converters for R, RL Loads.(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	2											1	3	2
CO2	2	2										1	3	2
CO3	2	2										1	3	2
CO4	3	3										1	3	2

Syllabus		
Unit No.	Contents	Mapped CO
I	**Power Semiconductor Switches**: Power Diode, Power IGBT, GTO, DIAC, Principle of operation and characteristics. Principle of operation of SCR, static, dynamic and gate Characteristics of SCR, Two-Transistor analogy of SCR, Triggering methods of SCR, Cosine firing scheme, Snubber Circuit, series and parallel connections of SCRs–static and dynamic equalizing networks, specifications and ratings of SCRs .	CO1
II	**AC –DC Converters(Rectifiers):**Phase angle control, single phase half wave and full wave(mid point) controlled rectifiers with R and RL load, half controlled (symmetrical configuration) and fully controlled bridge rectifiers with R, RL loads - effect of source inductance. Three phase half and fully controlled bridge converters- with R and RL loads, effect of source inductance, dual converters (both single phase and three phase).	CO2 CO4

III	**DC to AC Converters (Inverters):** Series Inverter and Parallel Inverter single phase full bridge inverters, comparison between VSI & CSI, three phase VSI (180 &120-degree conduction modes). Introduction to Multi level Inverters-Cascaded H Bridge inverter (principle of operation). Voltage control techniques for inverters**:** Pulse-width modulation techniques - single pulse, multi-pulse, sinusoidal pulse width modulation techniques.	CO3 CO4
IV	**DC to DC Converters (Choppers)** – Control strategies of chopper, Buck, Boost, Buck-boost choppers- Derivation of average load voltage and current expressions, Four quadrant chopper (principal of operation),AC chopper .	CO2 CO4
V	**AC to AC converters(AC Voltage controllers and Cyclo-converters) :** Two SCR's in anti parallel with R and RL loads, derivation of RMS load voltage, current and power factor. Cyclo converters – single phase mid-point and bridge type cyclo converters with resistive and inductive load.(Principle of operation).	CO3 CO4

Learning Resources

Text Books

1. P.S. Bhimbra,'Power Electronics',5th edition, KhannaPublications
2. M. H. Rashid, 'Power Electronic Circuits Devices and Applications',4th edition, Pearson .
3. M.D. Singh and K.B. Kanchandani ,'Power Electronics',2nd edition ,McGraw Hill Publications,

Reference Books

1. Ned Mohan, Tore M. Undeland, and William P. Robbins, "Power Electronics Converters Applications and Design", 3rd edition, McGraw-Hill Education.
2. P.C.Sen Power Electronics , 2nd edition Tata Mc Graw-Hill Publishing
3. Vedam Subramanyam ,'Power Electronics-Devices Converter Applications',2nd edition, New Age International (P) Limited .

e- Resources & other digital material

1. www.nptel.ac.in/courses/108101038/

ENVIRONMENTAL MANAGEMENT

Course Code	19ES5601A	**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**	19BS1103-Chemistry of Materials
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 sources and composition of Municipal Solid Waste
CO2	**Distinguish** between different solid waste management methods and relate its effect on soil
CO3	**Determine** different types of Hazardous wastes and their safe disposal methods
CO4	**Illustrate** importance of EIA and its assessment methodologies
CO5	**Assess** impacts of air and water and their significance

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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	2	1		1		2	2					1	2
CO2	3		2		2		2	2					1	2
CO3	3		2		1		2	2					1	2
CO4	3		1		1		2		1				1	2
CO5	3		1		1		2		1				1	2

Course Content

UNIT-1	Introduction: Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization, segregation of solid wastes – source reduction of waste – objectives of waste processing, elements of solid waste management – municipal and bio medical solid waste rules – public role in solid waste management.	CO1.
UNIT-2	Resource recovery from solid waste composting and biomethanation; materials- soil pollution: sources, types of soil pollution, effects of fertilizers, pesticides and radioactive material on soils, land disposal of solid waste; sanitary landfills – site selection; landfill liners – management of leachate.	CO2.
UNIT-3	Hazardous Waste Management: Sources and types of hazardous waste characteristics of hazardous wastes; collection-handling-processing techniques-disposal methods; hospital waste management - processing techniques - disposal.	CO3

UNIT-4	Conceptual Facts of EIA: Introduction, definition and scope of EIA objectives in EIA, basic EIA principles, classification of EIA, strategic EIA (SEIA), regional EIA, sectoral EIA, project level EIA and life cycle assessment, project cycle, Environmental baseline monitoring (EBM), preliminary study to determine impact significance, Impact Assessment Methodologies.	CO4
UNIT-5	Prediction of Impacts (Air and Water): Air and water environment, sources and basic information on water and air conceptual approach for addressing air and water environment impacts, assessment of impacts air, water, noise, soil, biological and socioeconomic impacts, assessment of impact significance.	CO5
Learning Resources		
Text Books	1. Integrated Solid waste management by Goerge Tchobanolous, Hilary Theisen & Samuel A. Vigil. McGraw Hill International Editions 2. Y. Anjaneyulu, Environmental Impact Assessment, B.S. Publications, 2003.	
Reference Books	1. CPCB Manual on solid waste Management 2. Technological guidance manuals of EIA, MoEF 3. M. Anjireddy, Textbook of Environmental Science and Technology, BS Publications, 2010.	
e-Resources & other digital material	1. www.nptel.ac.in/courses/120108005 2. nptel.ac.in/courses/10510605 3. https://www.coursera.org/learn/solid-waste-management	

TELECOMMUNICATIONS FOR SOCIETY

Course Code	19ES5601B	**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**	--
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.
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..
CO3	Make use of revolutionary changes in mobile and wireless technologies to understand recent developments(L3).
CO4	Examine different optical communication components..
CO5	Justify the use of satellite orbits, different components and sub-systems in advanced communication 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

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

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 Metropolitan-	**CO3**

	Area Networks	
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.

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				

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

Netzwerk A1 Deutsch als Fremdsprache by Goyal Publications, New Delhi

E- Resources & other digital material:

https://learngerman.dw.com/en/overview

https://onlinecourses.nptel.ac.in/noc22_hs30/

https://app.memrise.com/German-1

ANALYTICAL ESSAY WRITING

Course Code	19HS5601C	**Year**	III	**Semester**	II
Course Category	Open Elective-II	**Branch**	Comm on 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.
CO2	Classify various types of analytical topics according to context and make reports. Organize the topic and prepare hypothesis
CO3	Construct meaningful arguments by following thematic information and suitable language.(L3)
CO4	Analyze thesis statement, topic sentences, evidence, and supporting ideas.
CO5	Distinguish the general essays from analytical essays and reorganize the content.

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		

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 Nehru, Jiddu Krishna Murthy, Iris Murdoch, Woolf Bacon, RW Emerson, Samuel Johnson, George Orwell, James Baldwin, Agatha Christie, Jane Austen etc.	CO1, CO2, CO5

LEARNING RESOURCES
Text Book:
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: https://canvas.harvard.edu/courses/8124 https://boomessays.com/blog/how-write-analytical-essay#definition https://www.ranker.com/list/best-essayists/ranker-books

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	

Syllabus		
Course Content		
UNIT-1	**Economic Development: A theoretical back ground:** Economic growth, development and under development. 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
UNIT-2	**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
UNIT-3	**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 capital, Balance of	CO3

	payments, WTO and India.	
UNIT-4	**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**
UNIT-5	**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. 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. **4.** .A. Musgrave and P.B. Musgrave, Public Finance in Theory & Practice,Mc Graw Hill Publications, 5th edition, 1989.	

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	
Upon successful completion of the course, the student will be able to:	
CO1	Describe the scope and significance of public administration
CO2	Explain different administrative thoughts.
CO3	Illustrate accountability and control over administration by different groups in society
CO4	Explain the concepts of union and state government administration
CO5	Summarize the administration process in civil services

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

Syllabus		
Course Content		
UNIT-1	**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
UNIT-2	**Administrative Thought:** Scientific management theory, classical theory, bureaucratic theory, human relation theory, system theory	CO2
UNIT-3	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
UNIT-4	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
UNIT-5	Civil Services: Recruitment , training and other condition of services, district administration, role of collector, local self governing institutes – 73 rd and	CO5

	74 th constitutional amendments act.	
Learning Resources		
Text Books	1. Avasti, Maheswari , Public Administration,31/e, Lakshmi Narain Agarwal books, india 2. B.L.Fadia ,Kuldeep faida, Indian administarion,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 Contitution,21/e, Lexis Nexis Butterworths, Wadhwa Nagpur, 2013. 4. Ramesh K Arora , Rajini Goyal Indian Public Administration, 3/e New Age International publishers India ,1995	

NATIONAL SERVICE SCHEME (N.S.S.)

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.
CO2	Identify the needs and problems of the community and involve them in problem-solving.
CO3	Develop capacity to meet emergencies and natural disasters.
CO4	Take part in national integration and social harmony.
CO5	Apply their knowledge in finding practical solutions to individual and community problems.

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	

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.

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.
CO2	Demonstrate an ability to use effective verbal and non-verbal communication skills.
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.
CO5	Analyze texts, diagrams and improve both reading and writing skills which would help in academics as well as professional career.

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		

SYLLABUS		
UNIT NO.	**CONTENT**	Mapped CO
I	Verbal communication – conciseness, clarity, correctness Non-verbal communication – body language Barriers to communication Reading Short Passages, News Articles, Technical Papers and Short Stories - Note making and note taking.	CO1, CO2, CO5
II	Professional Letters – Purpose, Style and format. E- mail – format and etiquette. Presentation skills Group discussion	CO1, CO3, CO4

III	Technical Report writing – Types: Business/Technical, Components, Style and Formats – Writing a Technical Proposal. Administrative drafting and correspondence - Memos, Minutes and Web notes.	CO1, CO3, CO4
IV	Information transfer. Meeting skills Team dynamics	CO1, CO2, CO5
V	Job application - Resume – Structure of Resume/CV – covering letter – writing SOPs. 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, CO2, CO4

LEARNING RESOURCES
Reference Books:
1. Basu B.N. Technical Writing, 2011 Kindle edition 2. C Muralikrishna & Sunitha Mishra, Communication Skills for Engineers, 2 nd edition, NY: Pearson, 2011. 3. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014. 4. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
e- Resources & other digital material:
1. https://www.britishcouncil.org/english 2 http://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

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	

Syllabus		
Course Content		
UNIT-1	**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**
UNIT-2	**Financial Planning:** Concept of Financial Planning; Process of Financial Planning; Characteristics of Sound Financial Plans; Factors Affecting Financial Plan.	**CO2**
UNIT-3	**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**
UNIT-4	**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**

UNIT-5	**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.	

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

Syllabus		
Course Content		
UNIT-1	Introduction to Marketing: Definition, Nature, Scope, Importance of Marketing, Core Concepts of Marketing, Philosophies of Marketing.	**CO1**
UNIT-2	Market Segmentation ,Targeting and Positioning: Definition, Levels of Segmentation, Bases of Segmentation, Target Market, Positioning Strategies.	**CO2**
UNIT-3	Marketing Mix: 4P's, Classification of Products, Product Life Cycle (PLC)-Stages, New Product Development(NPD)- Types, Process	**CO3**
UNIT-4	Pricing: Definition, Objectives, Pricing Strategies- Channels of Distribution: Definition, Functions, Levels	**CO4**
UNIT-5	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.
Digital Resources	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/

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

Course Code	19EE3651	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	MPMC Basics
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 assembly language programs to perform various arithmetic and logical operations with 8086 micro-processors and 8051 micro-controllers.
CO2	Design various interfacing techniques related to real time applications.
CO3	Perform multiprocessor communication.

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	1	3	3								1	
CO2	3	3	3	3	3								3	3
CO3	3	3	1	3	3								2	2

Syllabus

	List of Experiments	
Expt. No.	**Contents**	**Mapped CO**
1	Introduction to MASM/TASM.	CO1
2	Arithmetic operations using 8086 Microprocessors – Multi byte addition and subtraction, Multiplication and Division, ASCII – arithmetic operation	CO1
3	Logic operationsusing 8086 Microprocessors – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.	CO1
4	Sorting of numbers using 8086 Microprocessors.	CO1
5	Arithmetic operations using 8051 Microcontrollers.	CO1
6	Checking 5^{th}bitusing 8051 Microcontrollers.	CO1
7	Display stringusing 8051 Microcontrollers.	CO1
8	Programs using special instructions like swap, bit/byte, set/reset etc.using 8051 Microcontrollers	CO1
9	Reading and Writing on a parallel port.	CO2
10	Traffic light Interface	CO2
11	Stepper Motor Interface	CO2
12	8259 – Interrupt Controller	CO2
13	Keyboard Interface	CO2
14	ADC Interface	CO2
15	Serial communication implementation using 8051 Microcontrollers	CO3

POWER ELECTRONICS LAB

Course Code	19EE3652	**Year**	III	**Semester**	II
Course Category	Program Core	**Branch**	EEE	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisite**	ECA Lab (19EE3351) ED&AC Lab (19EE3352)
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	Study and observe the characteristics of SCR and IGBT.(L2)
CO2	Analyse theoretically and practically Rectifiers.(L4)
CO3	Analyse theoretically and practically inverters.
CO4	Analyse theoretically and practically AC to AC converters.
CO5	Analyse the operation of Choppers.

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	2		2								1	3	2
CO2	2	2		2								1	3	2
CO3	2	2		2								1	3	2
CO4	2	2		2								1	3	2
CO5	2	2		2								1	3	2

Syllabus		
Expt. No.	Contents	Mapped CO
PART-A (Any Eight Experiments)		
1	Study of characteristics of SCR	CO1
2	Study of characteristics of IGBT	
3	Single phase fully controlled bridge converter with R and RL loads	CO2
4	Three phase half controlled bridge converter with RL-Load	
5	VSI fed three phase induction motor drive	CO3
6	Single phase Series inverter	
7	Single phase AC Voltage controller with R and RL loads	CO4
8	Single phase cyclo-converter with R and RL loads	
9	IGBT based four quadrant chopper controlled DC motor drive	CO5
10	Buck Converter	

PART-B: (Any Two Experiments)		
11	Single phase dual converter with R, RL and RLE loads	CO2
12	Boost Converter	CO5
13	Single phase Parallel inverter	CO3
14	Single phase bridge inverter	
15	Cascaded H Bridge inverter	
Learning Resources		
Text Books		
1. P.S. Bhimbra,'Power Electronics',5th edition, KhannaPublications 2. M. H. Rashid, 'Power Electronic Circuits Devices and Applications',4th edition, Pearson.		

ORGANIZATION BEHAVIOUR

Course Code	19HS1701	**Year**	IV	**Semester**	I
Course Category	Humanities & Social Sciences	**Branch**	EEE	**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.
CO2	Demonstrate the applicability of analyzing the complexities associated with management of individual behaviour in the organization.
CO3	Analyze the complexities associated with management of the group behaviours (Group Dynamics) in the organization and role of leadership.
CO4	Demonstrate how the organizational behaviour can integrate in understanding the motivation for creating positive work culture.
CO5	Demonstrate how the organizational behaviour can influence in understanding the importance of learning and leadership for an organization to create positive impact.

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

Syllabus		
Course Content		
UNIT-1	**Introduction to Organizational Behaviour and Culture:** Definition- Nature- Scope-Roles of Manager- Challenges-Opportunities- Creating and Maintaining Organizational Culture	**CO1**
UNIT-2	**Foundations of Individual Behaviour:** Perception: Definition-Factors- The Perception Process- Motivation: Definition- Factors-Theories of Motivation: Maslow's Hierarchy Theory of Needs-Herzberg's Theory-Expectancy Theory	**CO2**
UNIT-3	**Foundations of Group Behaviour:** Group-Definition- Types of Groups-Stages of Group Development- Group Decision Making- techniques-Johari Window- Transactional Analysis	**CO3**

UNIT-4	**Managing Group Behaviour**- Team- Definition- Types of Teams- Team Building- Conflict – Intra-Personal and Inter Personal Conflict	**CO4**
UNIT-5	**Leadership**- Definition- Types- Theories of Leadership: Trait theories- Contingency theories-**Learning**- Definition- Theories of Learning	**CO5**
Learning Resources		
Text Books	1. Aswathappa K., "Organizational Behavior-Text, Cases and Games", Himalaya Publishing House, New Delhi, 2008. 2. Stephen B. Robbins, "Organizational Behavior", PHI, New Delhi, 2008	
Reference Books	1. Pareek Udai: "Understanding Organizational Behavior", Oxford University Press, New Delhi, 2007. 2. Sharma V.S., Veluri: "Organizational Behavior", JAICO Publishing House, New Delhi, 2009. 3. Mary Ann Von Glinow, Radha R. Sharma, Steven L. McShane, "Organizational Behavior", Tata McGraw Hill Education, New Delhi, 2008.	

POWER SYSTEMS-II

Course Code	19EE3701	**Year**	IV	**Semester**	I
Course Category	Program core	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	BEEE, PS-I
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 per unit representation, importance of power flow studies and fault studies
CO2	Analyze power flows and different types of faults in a power system
CO3	Investigate stability and load frequency control of power system
CO4	Solve the economic dispatch problem with and without losses

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	2											1	1
CO3	2			2		1							1	1
CO4	3	2											1	

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Per unit Representation and Power Flow Studies** Single line diagram, per unit quantities, per unit impedance diagram of a power system, Y bus formation by direct inspection method. Necessity of power flow studies - Derivation of static load flow equations– Load flow solutions using Gauss Seidel Method, Newton Raphson method, Fast Decoupled methods - algorithm and flowchart, Comparison of Different methods of load flow, numerical Problems (max. 3-buses and one iteration only)	CO1 & CO2
II	**Short Circuit Analysis** Necessity of fault studies, Types of faults, symmetrical components - positive, negative and zero sequence components of voltage, current and impedance. Sequence Networks - LG, LL, LLG faults with and without fault impedance - numerical Problems	CO1 & CO2
III	**Stability Analysis** Concepts of steady state, dynamic and transient stabilities - transfer reactance, synchronizing power coefficient, power angle curve - determination of steady state stability and methods to improve steady state stability - Derivation of swing equation – Determination of transient stability by equal area criterion, application of equal area criterion to	CO3

	sudden change in mechanical input–derivation of critical clearing angle and critical clearing time - Methods to improve transient stability.	
IV	**Load Frequency Control** Modeling of speed governing system, turbine model, generator and load model - Automatic generation control of a single area system, steady state analysis, dynamic response, PI control of single area system - two area system, tie-line bias control.	CO3
V	**Economic Operation of Power Systems** Optimal operation of generators in thermal power stations, heat rate curve, cost curve, incremental fuel and production costs - Derivation of coordination equation for economic dispatch problem with and without losses - numerical Problems	CO4

Learning Resources
Text Books:
1. Modern power system analysis - D.P.Kothari and I.J.Nagrath - 4th edition - TMH publications 2. Power system analysis - HadiSaadat – 4th edition- TMH publications. 3. Power Generation, Operation, and Control - Wood and Wollenberg- 3rd edition - Wiley Publishers 4. Electric Energy systems Theory - O.I.Elgerd, 2nd edition - TMH Publishers
Reference Books:
1. Power System Analysis: Operation and Control - AbhijitChakrabarti, SunitaHalder – 3rd edition PHI Learning. 2. Power System Analysis and design - B.R.Gupta,- 4thEdition S.Chand Publishers. 3. Electrical Power Systems - Ashfaq Husain - 7thedition - CBS Publishers & Distributors.

HIGH VOLTAGE ENGINEERING

Course Code	19EE4701A	**Year**	IV	**Semester**	I
Course Category	Program Elective-IV	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Power 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	**Analyze** with the generating principle of operation and design of high voltages and high currents.(L3)
CO2	**Understand** different methods for measurement of high voltages and high currents.
CO3	**Acquaint** the need for testing techniques of high voltage equipment's

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

Note:1-Weakcorrelation2-Mediumcorrelation3-Strongcorrelation

*-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	2	2	2							2	2
CO2	3	2	2	2	2	2							2	2
CO3	3	2	2	2	2	2							2	2
CO4	3	2	2	2	2	2							2	2
CO5	3	2	2	2	2	2							2	2

Syllabus

Unit No.	Contents	Mapped CO
I	**Generation of High Direct Current and Alternating Current Voltages** Generation of High DC Voltages: Principle of Voltage doubler circuits, Voltage multiplier circuits and Van de Graaff Generators. Generation of High AC Voltages: Cascade transformers and resonant transformers. Generation of High-Frequency ac High Voltages: Tesla coil arrangement.	CO1
II	**Generation of Impulse Voltages and Impulse Currents** Generation of Impulse Voltages: Standard impulse wave shapes, Circuits for producing impulse waves and Multistage impulse generators-Marx Circuit. Generation of Impulse Currents: Circuit for producing impulse current waves, Impulse current generator and Tripping and control oh impulse generators.	CO1
III	**Measurement of High Voltages** Measurement of High DC Voltages: Series resistance micro ammeter, Resistance potential divider, Generating voltmeters and Sphere and other spark gaps. Measurement of High AC Voltages (Power Frequency):Series impedance ammeters, Potential dividers, Potential transformers, Electrostatic voltmeters and Sphere gaps. Measurement of High AC Voltages (High Frequency) and Impulse Voltages: Potential dividers, Peak voltmeters and sphere gaps.	CO2

IV	**Measurement of High Currents:** Measurement of High Direct-Currents, Measurement of High Alternating currents and Measurement of Impulse Currents	CO2
V	**High-Voltage Testing of Electrical Apparatus:** Testing of insulators and bushings, Testing of isolators and circuit breakers, Testing of cables, Testing of transformers, Testing of surge arresters and Radio interference measurements	CO3

Learning Resources

Text Books

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju, McGraw Hill Education (India) Private Limited, 4th Edition.
2. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 2nd Edition.

ReferenceBooks

1. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl and J.Kuffel, Elsevier, 2nd Edition.

e-Resources&otherdigitalmaterial

1. https://nptel.ac.in/courses/108/104/108104048/
2. https://www.btechguru.com/courses--nptel--electrical-engineering--high-voltage-dc-transmission-video-lecture--EE--EE100024V.html

HIGH VOLTAGE DIRECT CURRENT

Course Code	19EE4701B	**Year**	IV	**Semester**	I
Course Category	Program Elective IV	**Branch**	EEE	**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	**Identify** HVDC power terminal equipment, classify type of HVDC connectivity and planning of HVDC system.(L2)
CO2	**Understanding** the choice of pulse conversion, control characteristic, firing angle control.
CO3	**Interpret** different types of converter control techniques
CO4	Able to **calculate** voltage and current harmonics, and design of filters and understand the reactive power necessity of conventional control.
CO5	**Investigate** Protection requirements, factors affecting power flow analysis and **analyse** real-time system.

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	2		2			2					2	2	2
CO2	3	2	2										2	2
CO3							2						2	2
CO4	3	2	2				2						2	2
CO5	2	2	2				2						2	2

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Basic Concepts of DC Transmission** Components of HVDC transmission systems: Types of HVDC Links – Comparison of AC & DC transmission – Application of DC Transmission System – Planning and Modern trends in DC transmission, HVDC light.	**CO1**
II	**Analysis of HVDC Converters** Choice of Converter configuration – Analysis of Graetz – Characteristics of 6 Pulse – converter operation –Equivalent circuit –12 Pulse converters configurations –Small HVDC tapping.	**CO2**
III	**Converter and System Control** Principle of DC Link Control – Individual phase control, Equidistant firing control Constant-current loop – Inverter extinction-angle control – Starting and stopping of DC-link – Power Control.	**CO3**

IV	**Harmonic analysis, Filters** – Characteristics and Non–Characteristics harmonics – Calculation of AC Harmonics —effects of harmonics – Calculation of voltage & current harmonics – Effect of Pulse number on harmonics. Design of AC filters **Reactive Power requirement** – Need of reactive power compensation in HVDC system, sources of reactive power.	**CO4**
V	**Faults ,Protection and case study of HVDC system** Converter faults–over current and over voltage protection in converter station –Case study of any existing HVDC link in India, Case study of any existing HVDC link in the world. **Power flow analysis in AC/DC systems** Component models, solution of DC load flow, Parallel operation of HVDC/AC systems, Multi-terminal systems.	**CO5**

Learning Resources
Text Books:
1. HVDC Power Transmission Systems: Technology and System Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers. 2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons
Reference Books:
1. HVDC Transmission – J. Arrillaga. 2. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.
Learning Resources: https://nptel.ac.in/courses/108/104/108104013/ https://www.brown.edu/Departments/Engineering/Courses/ENGN1931F/HVDC_Proven_TechnologySiemens.pdf

PROCESS CONTROL

Course Code	19EE4701C	**Year**	IV	**Semester**	I
Course Category	Program Elective-IV	**Branch**	EEE	**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 technical terms and concepts associated with process control domain
CO2	Analyze the basic control actions used in process industries
CO3	Develop, tune and implement PID Controllers to achieve desired performance for various processes
CO4	Develop & implement control schemes for various processes control applications
CO5	Extend the performance of the complex systems with advanced control strategies

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						2							
CO2			3			3								
CO3			3								3		3	
CO4			2				3		2					2
CO5					1			2				1		1

SYLLABUS

Unit No.	Contents	Mapped CO
I	**Introduction to Process control:** Terms and objectives, piping and Instrumentation diagram, instrument terms and symbols. Regulatory and servo control, classification of variables. Process characteristics: Process equation, degrees of freedom, modeling of simple system, Self-regulating processes, interacting and non- interacting processes, Process lag, load disturbance and their effect on processes	**CO1**
II	**Controller modes:** Basic control action, two position, multi-position, floating control modes. Continuous controller modes: proportional, integral, derivative. Composite controller modes: P-I, P-D, P-I-D, Integral wind-up and prevention. Auto/Manual transfer, Bump less transfer. Response of controllers for different test inputs. Selection of control modes for processes like level, pressure, temperature and flow.	**CO2**

III	**Final control elements:** Pneumatic and electrical actuators, Valve positioners. Pneumatic and electrical dampers, Control valves types, construction details, various plug characteristics. Energy efficient valves - Valve sizing - selection of control valves. Inherent and installed valve characteristics. Fail-safe operation, Cavitations and flashing in control valves, Instrument air supply specifications.	**CO3**
IV	**Controller tuning Methods:** Evaluation criteria - IAE, ISE, ITAE. Process reaction curve method, continuous oscillation method, damped oscillation method. Auto tuning. Closed loop response of I & II order systems, with and without valve, measuring element dynamics.	**CO4**
V	**Advanced control system:** Cascade control, ratio control, feed forward control. Over-ride, split range and selective control. Multivariable process control, interaction of control loops. Introduction to Dynamic Matrix Control. Case Study, boiler drum level control.	**CO5**

Learning Resources

Text Books:

1. K.Krishna swamy, Process control, Anshan Publishers .2nd edition,june 2011.
2. Surekha Bhanot , Process control principles and applications , oxford university press, 2008.
3. D.R. Coughanowr, Steven E LeBlanc, Process Systems Analysis and Control, McGraw Hill, Singapore, 3rd Edition, 2009.
4. G.Stephanopoulos, Chemical Process Control-An Introduction to Theory and Practice Prentice Hall of India, New Delhi, 3rd Edition, 2008.

Reference Books:

1. B.W. Bequette, Process Control Modeling, Design and Simulation, Prentice Hall of India, New Delhi, 2004.
2. C.A.Smith and A.B Corripio., Principles and Practice of Automatic Process Control, John Wiley and Sons, New York, 3rd Edition 2005.
3. Paul W.Murril, Fundamentals of Process Control Theory, ISA press, New York, 3rd Edition, 2000.
4. Bela G. Liptak, Instrument Engineers' Handbook, Volume II: Process Control and Optimization, CRC Press, 4th Edition, 2005.

Learning Resources:

https://nptel.ac.in/courses/103/105/103105064/

WIND AND SOLAR ENERGY

Course Code	19EE4702A	**Year**	IV	**Semester**	I
Course Category	Program Elective V	**Branch**	EEE	**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 must be able to	
CO1	**Understand** the basics of wind energy, wind turbines, solar energy and grid integration.
CO2	**Explain and classify** wind turbines**,** instruments for measuring solar radiation, solar collectors, solar cell and solar MPPT techniques
CO3	**Analyze** different types of wind generators, solar cell and solar collectors
CO4	**Outline** about integration of solar and wind energy systems

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		2			3					2	3	2
CO2	3	2		3			3					2	3	2
CO3	3	1		3			3					2	3	2
CO4	3	1		3			2					2	3	2
CO5	3	1		2			3					2	3	2

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Wind energy Basics** History of wind power, Indian and Global statistics, Characteristics of Wind, principles of wind energy conversion, components of wind energy conversion system, classification of wind turbines- horizontal axis and vertical axis , Betz limit ratio, advantages and disadvantages of wind energy system.	**CO1** **CO 2**
II	**Wind turbine technologies** Review of modern wind turbine technologies, Fixed and Variable speed wind turbine, Squirrel-cage Induction generator, Wound rotor motor induction generators, Doubly Fed Induction Generator, Synchronous Generators, Permanent Magnet Synchronous Generators and their characteristics.	**CO 1** **CO 3**
III	**Solar Thermal**	**CO 1**

	Physics of the sun, the solar constant, extraterrestrial 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 2** **CO 3**
IV	**Solar photovoltaic** Photovoltaic energy conversion, solar cell fundamentals, solar cell classification- Amorphous, mono-crystalline, polycrystalline, performance of solar cell, V-I characteristics of a PV panel, Maximum Power point Tracking (MPPT) algorithm	**CO1** **CO2** **CO 3**
V	**Integration of solar and wind** Wind power integration into grid-power system stability, economics of grid network, codes and standards for grid integration, grid connected PV systems, control scheme used for single stage grid connected PV system, case study on hybrid system(PV-Wind)	**CO 1** **CO 4**

Total Periods: 45, 9 periods for each unit.

Learning Resources
Text Books:
1. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition,2014. 2. Wind Energy Theory and Practice by Siraj Ahmed publisher PHI learning Pvt Ltd ,3rd edition, 2016 3. Renewable Energy Sources and Emerging Technologies by D.P Kothari, K.C Singal, RakeshRanjan , PHI learning Pvt Ltd, 2nd edition ,2012
Reference Books:
1. Renewable Energy resources byTiwari and Ghosal, publisher Narosa,2005 2. Solar Photo Voltaics Fundamentals, Technology and application by Chetan Singh Solanki, publisher PHI learning Pvt Ltd, 3rd edition,2019 3. Renewable Energy Resources by John Twidell and Tony Weir , publisher Taylor and Francis, 2nd edition 2006

POWER QUALITY & FACTS

Course Code	19EE4702B	**Year**	IV	**Semester**	I
Course Category	Program Elective-V	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Power Electronics, Power 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	**Observe** various Power Quality problems related to voltage and frequency. (L1)
CO2	**Identify** various sources of voltage disturbances and suggest suitable mitigating techniques.
CO3	**Observe** the concepts of various FACTS controllers.(L1)
CO4	**Estimate** the effect of shunt and series reactive compensation
CO5	**Illustrate** the impact of FACTS controllers on power systems.(L2)

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												2	2
CO2	2	2											2	2
CO3	2												2	2
CO4	2	2											2	2
CO5	2	2											2	2

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Power and Voltage Quality** General classes of power quality problems, Power quality terms, Power frequency variations, power quality evaluation procedure. Voltage quality Transients, long and short duration voltage variations, Voltage imbalance, Waveform distortion, Voltage flicker. **Voltage sags and Interruptions** Sources of sags and interruptions, Estimating Voltage sag performance.	**CO1, CO2**
II	**Fundamental Principles of Protection** Solutions at the end-user level, Evaluating economics of different ride-through alternatives, Motor-Starting Sags	**CO2**
III	**FACTS Concept and general system considerations** Flow of power in an AC system. Limits of the loading capability. Power flow and dynamic stability considerations of a transmission interconnection.	**CO3, CO5**

	Relative importance of controllable parameters, types of FACTS controllers, basic concepts of Active filter, UPFC,IPFC and DSTATCOM	
IV	**Static shunt compensators** Objectives of shunt compensation, midpoint voltage regulation for line segmentation, end of line voltage support to prevent voltage instability, methods of controllable var generation, variable impedance type static var generators – TCR and TSR, TSC, FC-TCR, TSC-TCR	**CO4** **CO5**
V	**Static series compensators** Concept of series capacitive compensation, improvement of transient stability, power oscillation damping. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC)	**CO4** **CO5**

Learning Resources
Text Books:
1. Electrical Power Systems Quality by Roger C.Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Third edition, TMH publishers,2012 2. Understanding FACTS, N.G.Hingorani and L.Guygi, Delhi IEEE Press 2001
Reference Books:
1. Understanding Power Quality Problems by Math H.J. Bollen, Wiley-IEEE press, 1999 2. Flexible AC transmission system (FACTS) by YONG HUE SONG and ALLAN T JOHNS, Institution of Electrical Engineers, London
Learning Resources: **https://nptel.ac.in/courses/108/106/108106025/** **https://nptel.ac.in/courses/108/107/108107114/**

DIGITAL CONTROL SYSTEMS

Course Code	19EE4702C	**Year**	IV	**Semester**	I
Course Category	Program Elective-V	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Control 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	**Explain and classify** discrete representation of LTI systems. L2
CO2	**Evaluate** knowledge on Z-Transforms in discrete time analysis. L5
CO3	**Examine** the conventional and state space methods for discrete systems L4
CO4	**Analyze** the stability criterion for digital systems and methods L4
CO5	**Develop** and design digital compensators explicitly compared to continuous time compensators. 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
CO2	3	3										2	3	3
CO3	3			2								2	3	3
CO4	3			2								2	3	3
CO5	3		3	2								2	3	3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction and signal processing:** Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Continuous and Discrete Time Signals – Sample and hold devices – Sampling theorem and data reconstruction(A/D&D/A) – Frequency domain characteristics of zero order hold.	CO1
II	**z–transformations:** z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.	CO2
III	**State space analysis and the concepts of Controllability and observability:** State space representation of discrete time systems – Solving Discrete Time state space equations – State transition matrix and its properties – Discretization of continuous time state equations – Concepts of controllability and observability – Kalman Test(without proof). **State Feedback Controllers and State Observers**	CO3

	Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula – Design of state observers (Full Order).	
IV	**Stability analysis:** Mapping between the s–Plane and the z–Plane – Primary strips and Complementary strips – Stability criterion – Modified Routh's stability criterion (bilinear transformation) and Jury's stability test.	CO4
V	**Design of discrete–time control systems by conventional methods:** Transient and steady state specifications – Design using frequency response in the w–plane for lag and lead compensators	CO5

Learning Resources
Text Books
1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition. 2. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
Reference Books
1. Digital Control and State Variable Methods by M.Gopal, TMH, 4th Edition

RENEWABLE ENERGY SOURCES

Course Code	19EE2701C	**Year**	IV	**Semester**	I
Course Category	Inter Disciplinary Elective-II	**Branch**	EEE	**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 must be able to	
CO1	**Understand** the basics of solar energy, wind energy, bio mass, geothermal energy, Ocean energy and principles of energy conversion.
CO2	**Explain and classify** instruments for measuring solar radiation **solar collectors, solar energy storages,** wind turbines**,** geothermal**,** MHD and fuel cell.
CO3	**Analyze** different types of solar collectors, solar cell, combustion characteristics of bio-gas, thermo dynamic cycles, operating conditions of fuel cell
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.

Contribution of Course Outcomes towards achievement of Program Outcomes &Strengths of correlations
L- Low M-Medium H-High

	PO1	PO2	PO3	P04	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

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, extraterrestrial 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:
3. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition,2014. 4. Renewable Energy Sources and Emerging Technologies by D.P Kothari, K.C Singal, Rakesh Ranjan , PHI learning Pvt Ltd, 2nd edition ,2012
Reference Books:
1. Renewable Energy resources byTiwari 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

WEB TECHNOLOGIES

Course Code	19IT2701C	Year	IV	Semester	I
Course Category	Inter Disciplinary Elective-II	Branch	EEE	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	
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
CO2	use Java script for validation of web pages
CO3	Analyze the concepts of DOM,JDBC Architecture and life cycles of Servlets and JSP
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	P04	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									

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.AllamRaju and othersApres(dreamtech)
6. Java Server Programming ,IvanBayross 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

OPTIMIZATION TECHNIQUES

Course Code	19ME2701B	**Year**	IV	**Semester**	I
Course Category	Inter Disciplinary Elective-II	**Branch**	EEE	**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
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

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

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/

PROJECT MANAGEMENT & OPTIMIZATION

Course Code	19ME2701C	**Year**	IV	**Semester**	I
Course Category	Inter Disciplinary Elective-II	**Branch**	EEE	**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
CO2	Analyze activities involved in project.(L3)
CO3	Describe various project cost management techniques(L2)
CO4	Apply various Linear programming techniques and sequencing methods
CO5	select transportation and assignment technique to minimize the cost

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

Syllabus		
Unit No	**Contents**	**Mapped CO**
Unit-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**
Unit-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**

Unit-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**
Unit-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**
Unit-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 (15th 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
1. https://nptel.ac.in/courses/105/106/105106149/
2. https://nptel.ac.in/courses/110/104/110104073/
3. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-ce06/
4. https://nptel.ac.in/courses/112/106/112106134/

POWER SYSTEMS LAB

Course Code	19EE3751	Year	IV	Semester	I
Course Category	Program Core	Branch	EEE	Course Type	Lab
Credits	1	L-T-P	0-0-2	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	Determine the parameters of various machines used in power systems.
CO2	Understand the characteristics of different relays used in electrical Industry.
CO3	Determine parameters, loading capability, compensation equipment required in practical transmission network.
CO4	Design and analyze modern power system networks by using simulink and MATLAB Softwares.

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	2											2	2
CO2	2	2											2	2
CO3	2	2											2	2
CO4	2	2			2								2	2

SYLLABUS		
	List of Experiments	**Mapped CO**
1	Determination of sub-Transient reactance of a salient pole synchronous machine.	CO1
2	Fault Analysis under occurrence of LG Fault & LL Fault.	CO1
3	Equivalent circuit of a three winding transformer.	CO1
4	Determination of positive, negative and zero sequence impedances of Cylindrical rotor synchronous machine.	CO1
5	Characteristics of microprocessor based under voltage relay.	CO2
6	Characteristics of microprocessor based over voltage relay.	CO2
7	Characteristics of electromagnetic type IDMT over current relay.	CO2
8	Characteristics of static negative sequence relay.	CO2
9	Characteristics of static biased differential relay.	CO2

10	Evaluation of ABCD parameters and surge impedance loading of transmission line.	CO3
11	Formation of Y-Bus by direct inspection method using MAT LAB	CO4
12	Transient stability studies using MAT LAB	CO4
13	Simulation of power system stabilizer using SIMULINK	CO4
14	Simulation of single area and two area systems using SIMULINK	CO4
15	Program to read and print out the power system load flow data of 5 BUS using MATLAB	CO4

Learning Resources
Reference Books:
1. MATLAB and its Tool Books user‘s manual by Math works, USA. 2. Fundamentals of Switchgear and Protection by J.B.Gupta , S.K. Kataria & Sons,2014. 3. Modern power system analysis by D.P.Kothari and I.J.Nagrath , TMH Publications. 4. Electrical power systems by C.L.Wadhwa, New Age International (P) Limited.

ARTIFICIAL INTELLIGENCE APPLICATION TO POWER SYSTEMS

Course Code	19EE4801A	**Year**	IV	**Semester**	II
Course Category	Program Elective-VI	**Branch**	EEE	**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 concept of different artificial intelligence concepts like Fuzzy systems, Artificial Neural Networks, Genetic Algorithm and PSO
CO2	**Analyse** the concepts of Fuzzy Logic and Artificial Neural Networks.(L4)
CO3	**Analyse** the concepts of Different Programming techniques like GA and PSO(L4)
CO4	**Apply** the different Artificial intelligence techniques to power system applications.(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														
CO2	3												2	2
CO3		3											2	2
CO4	3			2	2								2	2

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**FUZZY LOGIC:** Introduction, Comparison between Fuzzy and crisp logic, Fuzzy sets, Membership function, Basic fuzzy set operations, properties of Fuzzy set, fuzzy relations, Fuzzy interference system, Mamdani, Sugeno, Fuzzy rule based system, defuzzification methods.	**CO1,CO2**
II	**ARTIFICIAL NEURAL NETWORKS:** Fundamental concepts, Basic models, Learning rules, Single layer and multi-layer feed-forward and feedback networks, Supervised and unsupervised learning, Recurrent networks, Modular network, Self-organizing maps, Function networks, Neural network controller.	**CO1,CO2**
III	**GENETIC ALGORITHM:** Fitness function, different types GA operators 1. Roulette wheel selection 2. Stochastic remainder Roulette wheel selection, Rank selection, Tournament selection and stochastic universal sampling, different types of cross over methods.	**CO1,CO3**
IV	**PARTICLE SWARM OPTIMIZATION (PSO):** Basic concepts, Swarm intelligence, population, velocity updation, particle- best (pbest), global-best (gbest), velocity initialization, solution, Applications of PSO.	**CO1,CO3**

V	**APPLICATION OF AI TECHNIQUES:** Load forecasting, load flow studies, economic load dispatch, load frequency control, reactive power control, speed control of DC and AC motors.	**CO1,CO4**

Learning Resources
Text Books:
1. S.Rajasekaran and G.A.V.Pai Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi, 2003. 2. Clerc, M. "Particle Swarm Optimization". First Edition, Wiley-ISTE, 2006.
Reference Books:
1. Jacek M. Zurada, "Introduction to Artificial Neural Systems", 1st Edition, Jaico Publishing House, 2007. 2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", John Wiley & Sons, 2009. 3. F. Karray and C. De Silva, "Soft Computing and Intelligent Systems Design, Theory, Tools and Applications", Prentice Hall, 2004.

HYBRID ELECTRIC VEHICLES

CourseCode	19EE4801B	**Year**	IV	**Semester**	II
Course Category	Program Elective-VI	**Branch**	EEE	**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	**Define** and **Explain** the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
CO2	**Explain** the fundamentals of vehicle movement and performance of electric vehicle.(L2)
CO3	**Analyze** various electric drives suitable for hybrid electric vehicles.(L4)
CO4	**Discuss** different energy storage technologies used for hybrid electric vehicles and their control.(L6)
CO5	**Analyse** the use of different power electronics devices and electrical machines in hybrid electric vehicles.(L4)

Strength of Correlation between CO – PO , CO- PSO in scale of 1-3

1: Slight (low), 2: Moderate (medium) 3: Substantial (High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			3	2	1				3	3	2
CO2	3		3			2	3	1				3	3	2
CO3	3		2			3	3	1				3	3	2
CO4	3		3			3	1	1				3	3	1
CO5	3		3			3	2	1				3	3	3

Syllabus		
Unit No.	Contents	Mapped CO
I	**Introduction to Hybrid Electric Vehicles** History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. **Vehicle fundamentals** General Description of Vehicle Movement, Vehicle Resistance, Dynamic Equation, Basics of vehicle performance and braking performance.	CO1, CO2
II	**Hybrid Electric Drive-trains** Basic concept of hybrid drive train, introduction to various hybrid drive-train topologies. **Electric Drive-trains**	CO1, CO2

	Introduction to various electric drive-train topologies, Performance of Electric Vehicle, Tractive effort in normal driving, Energy Consumption.	
III	**Electric propulsion system** Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, Vector control of AC Drives, PMSM Drives, SRM Drives, Advanced Control Strategies.	CO3
IV	**Energy Storage** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.	CO4
V	**Power Electronics Control** Power Electronics in HEVs: Power electronics including switching, AC-DC, DC-AC conversion, electronic devices and circuits used for control and distribution of electric power, Thermal Management of HEV Power Electronics.	CO5

Learning Resources

Text Books

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003
2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

Reference Books

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. Seth Leitman, "Build Your Own Electric Vehicle" MC Graw Hill, 1st Edition, 2013.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108/103/108103009/

ROBOTICS

Course Code	19EE4801C	**Year**	IV	**Semester**	II
Course Category	Program Elective-VI	**Branch**	EEE	**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 concepts of Robotics
CO2	Obtain basic idea on working principle of various actuators and sensors, End Effectors
CO3	Analyze and Design the Robot , Safety in Robotics
CO4	Analyze the Control Hardware and Implement Robot Programming skills
CO5	Understand the Social Issues & future applications of a robot

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	2	1
CO2	3		2		2							1	2	1
CO3	3	2	3	2	2							1	2	1
CO4	3	3	3	2	2							1	2	1
CO5	3		2		1							1	2	1

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Fundamentals Concepts :**Introduction to Robot, Classification of Robots, What Is Robotics, History of Robotics ,Advantages and Disadvantages of Robots ,Robot Components ,Robot Degrees of Freedom ,Robot Joints , Robot Coordinates ,Robot Reference Frames , Programming Modes , Robot Characteristics , Robot Workspace ,Robot Languages ,Robot Applications ,Other Robots and Applications	CO1
II	**Robot End Effectors, Actuators:** Introduction, end effectors, types of end effectors, grippers and tools, Requirements and challenges of end effectors. **Actuators:** Electric Pneumatic, Hydraulic actuators, **Sensors, Vision and Signal Conditioning:** Sensors Classification, Internal Sources, External Sources, Vision ,Signal Conditioning, Sensor Selection	CO2
III	**Robot Cell Design and control-** Safety in Robotics, Robot cell layouts, Multiple Robots and machine interference, Interlocks, Workcell Controllers, and Robot cycle time analysis.	CO3
IV	**Control Hardware and Robot Programming:** Control Consideration, Hardware Architecture, Hardware for Joint Controllers, Computational Speed.	CO4

	Robot Programming: Methods of Robot Programming, Lead through Programming Methods, wait, signal and delay Commands, Branching, Capabilities and Limitations of Lead through methods.	
V	**Social Issues and Future Applications:** **Social Labor Issues:** Productivity and Capital Formations, Robotics and Labor, Education and Training, International Impacts . **Future Applications:** Robot Intelligence, Characteristics of future Robot Tasks, Future Manufacturing Applications of robots, Service Industry and Similar Applications	CO5

Learning Resources
Text Books
1. Introduction to Robotics: Analysis, systems and applications" by Niku. Saeed B." 2nd edition Wiley,2004. 2. Industrial Robotics Technology Programming and Applications by Mikell P.Groover, McGraw-Hill Int. Edition,2012 3. S.K.Saha "Introduction to Robotics "McGraw-Hill, New Delhi,2014
Reference Books
1. Introduction to Robotics – John J. Craig, Addison Wesley 2. Robotics – K. S. Fu, Gonzalez & Hee 3. Introduction to Robotics – Saeed B.Niku, Prentice Hall
e- Resources & other digital material
1. http://nptel.ac.in/downloads/112101098/ 2. http://engineering.nyu.edu/mechatronics/smart/Archive/intro_to_rob/Intro2Robotics.pdf

INTRODUCTION TO PYTHON PROGRAMMING

Course Code	19CS2801D	**Year**	IV	**Semester**	II
Course Category	Inter Disciplinary Elective -III	**Branch**	EEE	**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 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

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	O2
CO1	3													
CO2	3								3	3				
CO3	3													
CO4		3												

Course Content

UNIT-1	**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
UNIT-2	**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
UNIT-3	**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
UNIT-4	**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.	CO1,CO4

	Dictionaries: Creating and Accessing Dictionaries, Built-in Dictionary functions, List Vs Tuple Vs Dictionary.	
UNIT-5	**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

INSTRUMENTATION AND SENSOR TECHNOLOGIES OF CIVIL ENGINEERING APPLICATIONS

Course Code	19EC2801B	**Year**	IV	**Semester**	II
Course Category	Inter Disciplinary Elective -III	**Branch**	EEE	**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
CO2	Interpret the type of transducer based on the transduction principles(L2)
CO3	Identify the relevant transducer for measurement of physical quantities
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

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 Mechnanical Measuremnets & 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", 2nd Edition,TMH

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Course Code	19HS2801A	**Year**	IV	**Semester**	II
Course Category	Inter Disciplinary Elective -III	**Branch**	EEE	**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 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

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	

Course Content		
UNIT-1	**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**
UNIT-2	**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**
UNIT-3	**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**
UNIT-4	**Sourcing and Transporting:** sourcing decisions and transportation in supply chain – infrastructure suppliers of transport services –	**CO4**

	transportation economics.	
UNIT-5	**Pricing Product and Documentation:** Pricing - Revenue Management Lack of coordination and Bullwhip Effect - Impact of lack of coordination - Documentation - functions and types.	**CO5**
Learning Resources		
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 Approch 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	

TOTAL QUALITY MANAGEMENT

Course Code	19ME2801B	**Year**	IV	**Semester**	II
Course Category	Inter Disciplinary Elective -III	**Branch**	EEE	**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	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

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		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

Syllabus		
Unit No	**Contents**	**Mapped CO**
Unit-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**
Unit-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**
Unit-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.	**CO2**

	Continuous Quality Improvement - Juran Trilogy, PDCA Cycle, Kaizen-kaizen suggestion's, program introduction at work place, principles of kaizen. Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development	
Unit-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**
Unit-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:
1. Dale H.Besterfiled, "Total Quality Management", Pearson Education, Delhi, 2006. 2. K. C. Arora, "Total Quality Management", Kataria & sons., New Delhi, 2005.
Reference books
1. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2005. 2. Narayana V and Sreenivasan N.S., Quality Management - Concepts and Tasks, New Age International, Delhi, 1996.
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