B.Tech. FOUR YEAR DEGREE COURSE

ELECTRICAL & ELECTRONICS ENGINEERING

R22 Regulations

(Applicable for the batches admitted from 2022-2023)

VISHNU
UNIVERSAL LEARNING

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)
Approved by AICTE & Affiliated to JNTUK, Kakinada
Accredited with 'A+' Grade by NAAC & NBA
Vishnupur, Bhimavaram, West Godavari Dist., Andhra Pradesh, India, PIN - 534202

Email: info@svecw.edu.in, Website: www.svecw.edu.in

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN :: BHIMAVARAM
(Autonomous)

Vision

Transform the society through excellence in Education, Community empowerment and sustained Environmental protection.

Mission

- To achieve Academic excellence through innovative learning practices
- To instill self confidence among rural students by supplementing with co-curricular and extra-curricular activities
- To inculcate discipline and values among students
- To establish centers for Institute Industry partnership
- To extend financial assistance for the economically weaker sections
- To create self-employment opportunities and skill up gradation
- To support environment friendly Green Practices
- Creating innovation hubs

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN:: BHIMAVARAM
(AUTONOMOUS)
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

"To establish a knowledge hub in the field of Electrical & Electronics Engineering to meet the needs of the society"

MISSION

- To produce quality Electrical and Electronics Engineers
- To inculcate discipline and ethical values among the students
- To empower students to succeed in higher education and research

ACADEMIC REGULATIONS

B.Tech. FOUR YEAR DEGREE COURSE

R22 Regulations

(Applicable for the batches admitted from 2022-2023)

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)

Approved by AICTE & Affiliated to JNTUK, Kakinada

Accredited with 'A+' Grade by NAAC & NBA

Vishnupur, Bhimavaram, West Godavari Dist., Andhra Pradesh, India, PIN - 534202

Email: info@svecw.edu.in, Website: www.svecw.edu.in

THE DEGREE OF BACHELOR OF TECHNOLOGY – REGULAR/HONORS/MINOR
(With effect from 2022-2023)

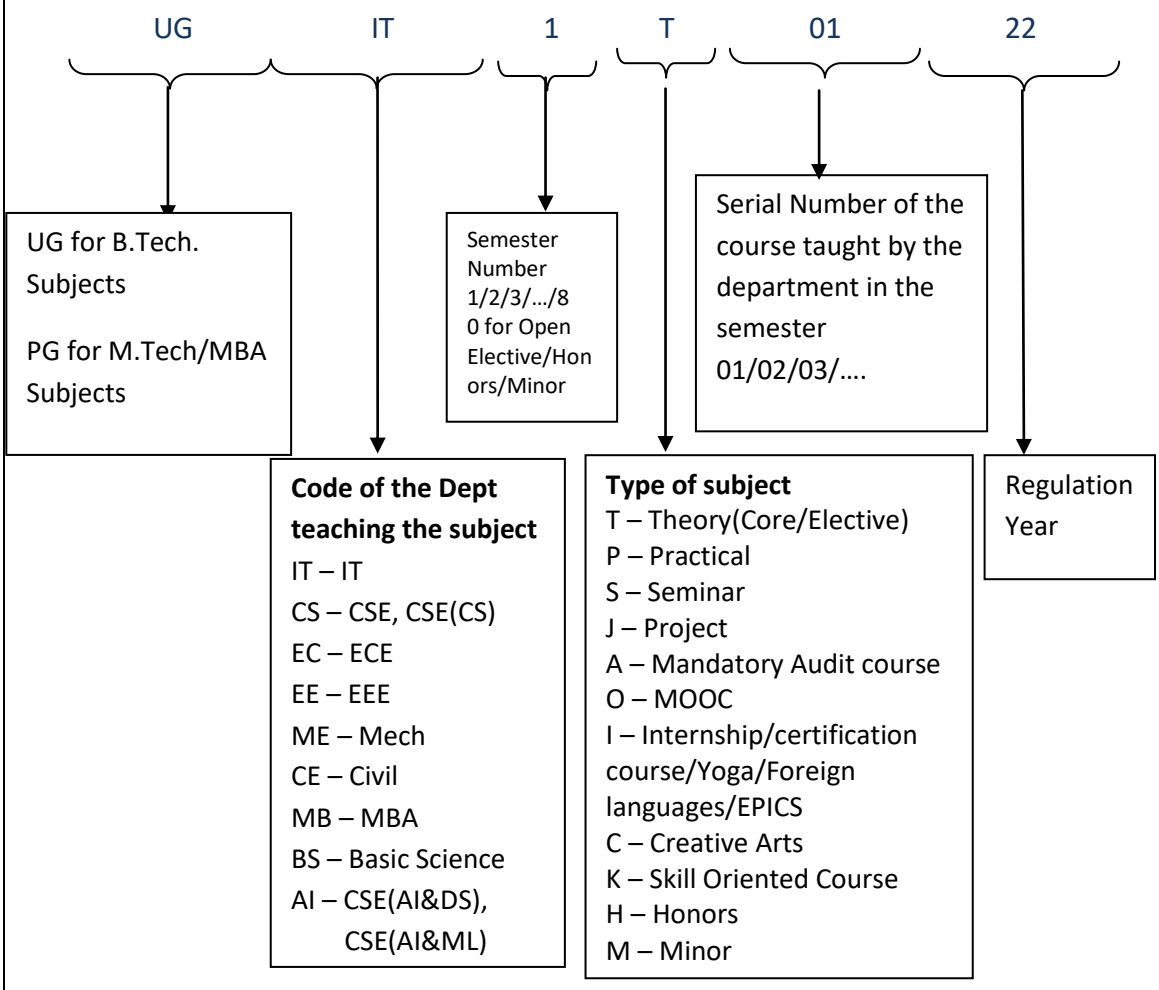
RB 0.0	**TITLE AND DURATION OF THE PROGRAM**
	The program shall be called the degree course in Bachelor of Technology, abbreviated as B.Tech.
	The program shall be of four academic years duration divided into eight semesters, each semester having duration of minimum 16 weeks.
	The calendar of events in respect of the program shall be fixed by the Institute from time to time.
	The external examination in all the subjects shall be conducted at the end of each semester for all the eight semesters.
	Students joining the B.Tech. programme shall have to complete the programme in a stipulated time frame of 8 years from the date of joining and students joining the B.Tech. Programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the programme in a stipulated time frame of 6 years from the date of joining otherwise; they shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled. One year extension shall be given to the students who availed the GAP year facility.
RB 1.0	**ELIGIBILITY FOR ADMISSION**
RB 1.1	Admissions are done as per the norms prescribed by Government. The Government orders issued from time to time in this regard shall prevail.
RB 1.2	The Candidate should have passed the qualifying examination, Intermediate or equivalent on the date of admission.
RB 1.3	Seats in each programme in the college are classified into CATEGORY-A (70% of intake) and CATEGORY – B (30% of intake) besides lateral entry.
RB 1.4	Category 'A' Seats shall be filled by the Convener, EAMCET Admissions. Category 'B' Seats shall be filled by the College as per the guidelines of Andhra Pradesh State Council of Higher Education. 'Lateral Entry' candidates (10% of the intake) shall be admitted into the Third semester directly based on the rank secured by the candidate in Engineering Common Entrance Test (ECET) in accordance with the instructions received from the Convener, ECET and Government of Andhra Pradesh.
RB 2.0	**AWARD OF B.TECH. DEGREE**
RB 2.1	A Student shall be declared eligible for the award of the B.Tech. Degree, if she pursues a course of study in not less than four and not more than eight academic years (plus maximum of 1 year of GAP year). A Student admitted into III semester shall be declared eligible for the award of the B.Tech. degree, if she pursues a course of study in not less than three and not more than six academic years (plus maximum of 1 year of GAP year).
RB 2.2	Each discipline of the B.Tech. programme is designed to have a total of 160 credits and the student shall have to complete the courses and earn all credits as per the requirements for award of the degree. Students joining the B.Tech. programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the courses, excluding first year courses and earn 121 credits as per the requirements for award of the degree.

RB 2.3	The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements. A Regular student (four-year programme) should register herself for 160 credits. To become eligible for the award of B.Tech. Degree, the student must obtain all 160 credits. A Lateral Entry student should register herself for 121 credits and should obtain all the credits. However, it is mandatory for the students to complete the noncredit courses
RB 2.4	A student shall be eligible for the award of B.Tech degree with Honors or Minor if she earns 20 credits in addition to the 160 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.
RB 3.0	**MINIMUM INSTRUCTION DAYS**
RB 3.1	The minimum instruction days for each semester shall be 90 working days.
RB 4.0	**COURSES OF STUDY**
RB 4.1	Branch Code - Branch Name 01 - Civil Engineering 02 - Electrical & Electronics Engineering 03 - Mechanical Engineering 04 - Electronics & Communication Engineering 05 - Computer Science & Engineering 12 - Information Technology 42 - CSE(Artificial Intelligence & Machine Learning) 45 - CSE(Artificial Intelligence & Data Science) 46 - CSE(Cyber Security)
RB 4.2	**Groups of Courses:** The courses in the B.Tech. Programme are grouped as Basic Science, Humanities and Social Science, Engineering Science, Professional Core, Professional Elective or Job Oriented Elective, Open Elective, Skill Oriented Course and Mandatory Audit Course. **Basic Science, Humanities and Social Science, Engineering Science and Professional Core Courses:** These are courses which are to be compulsorily studied by a student and it is the core requirement to complete the programme in a said branch. **Professional Elective or Job Oriented Elective Course:** A student can choose a course (subject) from a pool of courses of branch concerned, which add proficiency to the students. **Open Elective Course:** These are the courses offered by other branches. These courses are designed to lead to knowledge enhancement in multi-disciplinary domains. **Skill Oriented Course:** These courses will be designed by keeping the interest of the students and requirement of specific industry. **Mandatory Audit Course:** These courses allow a student to attend classes without the benefit of a grade for a course. An undergraduate student who audits a course does so, for the purpose of self-enrichment and academic exploration.
RB 5.0	**DISTRIBUTION AND WEIGHTAGE OF MARKS**
RB 5.1	The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 50 marks for practical subject. The main project work shall be evaluated for 200 marks, Summer Internship/Skill oriented courses/Seminar shall be evaluated for 50 marks.
RB 5.2	For theory subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Examinations.
RB 5.3	Internal evaluation 30 marks shall be awarded as follows: 25 marks for MID Exam (15 marks for Descriptive and 10 marks for Quiz) and 5 marks for Course Activity like Technical quiz, Capstone project, Case studies, Short talk, etc. The Descriptive examination is for 90 minutes duration conducted for 30 marks. Each descriptive examination question paper consists of 3 questions (either – or type) from two and half

	units. Three questions are to be answered, one from each unit. The descriptive examination conducted for 30 Marks is to be brought down to total marks of 15. The quiz examination is for 20 minutes duration (conducted with 20 multiple choice questions with a weightage of ½ Mark each). After every two and half Units, one Course activity shall be conducted. Course Activity shall be evaluated by the Departmental Committee consisting of Head of the Department and Course Coordinator. For theory subjects, during the semester there shall be 2 MID Examinations. As the syllabus is framed for 5 units, the First MID examination (both descriptive and quiz) is conducted from first two and half units and Second MID examination(both descriptive and quiz) is conducted from last two and half units of each subject. Internal marks can be calculated with 80% weightage for better of the two mids and 20% Weightage for other mid exam. Example: Mid-1 marks = Marks secured in(Descriptive examination-1 + Quiz examination-1 + Course Activity-1) Mid-2 marks = Marks secured in(Descriptive examination-2 + Quiz examination-2 + Course Activity-2) Final Internal Marks =Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2 If a student is absent for any one MID examination, she can appear for a Grand Test after MID-2. The Grand Test will be conducted with questions covering the entire syllabus. The marks in the grand test is reduced to 25 marks and to be considered for respective MID.
RB 5.4	The end semester examination is conducted for 70 marks by covering the topics of all units. Part-A contains mandatory short answer questions, 5 questions for total 10 marks covering all the units. Part-B contains 10 questions (two from each unit with either – or choice) of 12 marks each. 1 question has to be answered from each unit (5 x 12 = 60 marks).
RB 5.5	For practical subjects, there shall be continuous evaluation during the semester for 15 internal marks. Out of the 15 marks for internal, day-to-day work 5 marks, Record 5 marks and 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted for 35 marks by the internal examiner and external examiner.
RB 5.6	For the subject having design and/or drawing (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for day–to–day work, and 15 marks for MID tests) and 70 marks for end examination. Mid marks can be calculated with 80% weightage for better of the two mids and 20% Weightage for other mid exam.
RB 5.7	For the seminar, the student shall collect the information on a specialized topic and prepare a technical report showing her understanding over the topic, and submit to the department, which shall be evaluated by the Departmental Committee consisting of Head of the Department, seminar supervisor and senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.
RB 5.8	Out of a total of 200 marks for the main project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the Committee. The Committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the Eighth semester. The Internal Evaluation marks shall be on the basis of Two seminars given by each student on the topic of her project and evaluated by an Internal Committee, consisting of Head of the department, supervisor of the project and a senior faculty member.
RB 5.9	For Internship(2 Months Mandatory during summer vacation), 50 marks shall be for Internal Evaluation. A supervisor/mentor/advisor has to be allotted to guide the students for taking

	up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. The student shall submit the report to the department after completion of her Internship. A certificate from industry/skill development center shall be included in the report. Viva-Voce shall be conducted by the Departmental Committee consisting of Head of the Department, supervisor of the internship and a senior faculty member of the department. The Viva–Voce may be conducted along with respective semester lab external examinations. The report and the Viva-Voce shall carry 40% and 60% weightages respectively. There shall be no external examination for Internships.	
RB 5.10	Laboratory marks and the internal marks awarded by the department are not final. The marks are subjected to be scrutinized and scaled by the Institute wherever it felt desirable. The internal and laboratory marks awarded by the department shall be referred to a Committee if required. The Committee shall arrive at a scaling factor and the marks shall be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved for two years after the final examinations of that semester in the respective departments as per the norms of the Institute and shall be produced to the Committees as and when they ask for.	
RB 6.0	**PROGRAMME STRUCTURE**	
	Basic Science Courses	18 to 21 credits
	Engineering Science Courses	20 to 24 credits
	Humanities and Social Science including Management Courses	10 to 11 credits
	Professional Core Courses	50 to 54 credits
	Professional Elective Courses	13 to 16 credits
	Project/ Internships / Certification Courses/ Seminar	15 to 18 credits
	Open Elective or Job Oriented Elective Courses	10 to 14 credits
	Skill Oriented Courses	10 Credits
	Mandatory Audit Courses – courses without credits	-
RB 7.0	**SCHEME OF INSTRUCTION FOR I, II, III AND IV YEARS**	
RB 7.1	The Schemes of Instruction and syllabi of all B.Tech. programmes are given separately, which are approved by the BOS concerned and the Academic Council.	
RB 8.0	**CONTACT HOURS AND CREDITS**	
RB 8.1	One hour of Lecture/Tutorial is equivalent to 1 credit and one hour of practical work/field work is equivalent to 0.5 credit.	
RB 8.2	THEORY / TUTORIAL CLASSES Each course is prescribed with fixed number of lecture periods per week. During lecture periods, the course instructor shall deal with the concepts of the course. For certain courses, tutorial periods are prescribed to give exercises to the students and to closely monitor their learning abilities and achievements.	
RB 8.3	LABORATORY / DRAWING COURSES A minimum prescribed number of experiments/drawings/jobs/programmes have to be performed by students, who shall complete these in all aspects and get each experiment evaluated by teacher concerned and certified by the Head of the Department concerned at the end of the semester.	
RB 9.0	**MEDIUM OF INSTRUCTION**	
RB 9.1	The Medium of Instruction and examination is in English.	
RB 10	**ATTENDANCE REQUIREMENTS**	
RB 10.1	In each semester the candidate has to put in a minimum attendance of 75% with a provision of condonation of 10% of the attendance by the Principal on the specific recommendation of the HOD, showing some reasonable cause such as medical grounds, participation in	

	University level sports, cultural activities, seminars, workshops, paper presentation etc. A student is eligible to write the University examinations if she acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.
RB 10.2	Shortage of attendance below 65% in aggregate shall not be condoned.
RB 10.3	A stipulated fee of Rs. 500/- in the concerned semester shall be payable towards condonation of shortage of attendance. Students availing condonation on medical ground shall produce a medical certificate issued by the competitive authority.
RB 10.4	Students whose shortage of attendance is not condoned will be detained and the student has to re-register for that semester when it is offered by the department.
RB 10.5	Rules for calculation of attendance for the re-admitted candidates who were detained for want of attendance or who had break – in study for various reasons: a) No. of classes conducted shall be counted from the day one of the semester concerned, irrespective of the date of payment of tuition fee. b) They should submit a written request to the Principal, along with a challan paid towards tuition and other fee, for re-admission before the commencement of class-work. c) Student should come to know about the date of commencement of class-work of the semester into which she wishes to get re-admission. The information regarding date of commencement of class-work for each semester is available in the college notice boards/ website.
RB 11.0	**CONDITIONS FOR PASS AND AWARD OF CREDITS FOR A COURSE**
RB 11.1	A candidate shall be declared to have passed in individual theory/drawing course if she secures a minimum of 40% aggregate marks (40 marks out of 100, Internal and semester end examination marks put together), subject to a minimum of 35% marks (24 marks out of 70) in semester end examination. For successful completion of mandatory audit course the student must get a satisfactory(pass) grade from the department offering the course. If fails, she has to reappear whenever the course is offered.
RB 11.2	A candidate shall be declared to have passed in individual lab/project/seminar/ Internship/ Skill oriented course if she secures a minimum of 40% aggregate marks (Internal and semester end examination marks put together), subject to minimum of 35% marks in semester end examination.
RB 11.3	The student must pass the failed course by appearing the supplementary examination as per the requirement for the award of degree.
RB 11.4	On passing a course of a programme, the student shall earn assigned credits in that course.
RB 12.0	**TRANSITORY REGULATIONS**
RB 12.1	a) Discontinued or detained candidates are eligible for re-admission as and when next offered. b) The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted. c) In case of transferred students from other Universities/Institutions, credits shall be transferred to SVECW as per the academic regulations and course structure of SVECW. d) The students seeking transfer to SVECW from various other Universities / Institutions have to obtain the credits of any equivalent subjects as prescribed by SVECW. In addition, the transferred candidates have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by SVECW.
RB 12.2	A student shall be eligible for promotion to next semester of B.Tech. programme, if she satisfies the conditions as stipulated in Regulation RB10.
RB 12.3	Further, a student shall be eligible for promotion to V / VII Semesters of B.Tech. programme, if she acquires the minimum number of credits as given below: A student shall be promoted from Semester - IV to Semester - V or from Semester - VI to

	Semester - VII only if she fulfills the academic requirements of 40% of the credits from the exams for which results are declared. For Lateral Entry Student: A student shall be promoted from Semester - VI to Semester - VII only if she fulfills the academic requirements of 40% credits from the exams for which results are declared.
RB 13.0	**COURSE CODE AND COURSE NUMBERING SCHEME:** The subject codes shall be given by the Department teaching the subject. Each subject code contains 10 characters. The 10 Characters for each subject shall be coded as per the following guidelines.
RB 13.1	
RB 13.2	While giving the subject codes the Departments can follow the below steps. i. Collect the requirements from various Departments.(subjects which they have to teach for other Departments) ii. Prepare a list of all the subjects the Departments have to teach in that semester (for their Department as well as other Departments based on the requirements, they have collected in point i.) iii. Give subject codes to all these subjects following the guidelines given. iv. Communicate these subject codes(identified in point i) to various Departments. v. Use the subject codes identified in point iii to the subjects in their course structure.
RB 14.0	**CONSOLIDATED GRADE CARD**
RB 14.1	A consolidated grade card containing credits and grades obtained by the candidate shall be issued after completion of the four years B.Tech. Programme.
RB 15.0	**METHOD OF AWARDING LETTER GRADES AND GRADE POINTS FOR A COURSE**

<table>
<tr><td>RB 15.1</td><td>A letter grade and grade point shall be awarded to the student in each course based on her performance as per the grading system given below.
<table>
<tr><th>Percentage of Marks Range</th><th>Level</th><th>Letter Grade</th><th>Grade Point</th></tr>
<tr><td>≥ 90</td><td>Outstanding</td><td>A+</td><td>10</td></tr>
<tr><td>80-89</td><td>Excellent</td><td>A</td><td>9</td></tr>
<tr><td>70-79</td><td>Very Good</td><td>B</td><td>8</td></tr>
<tr><td>60-69</td><td>Good</td><td>C</td><td>7</td></tr>
<tr><td>50-59</td><td>Fair</td><td>D</td><td>6</td></tr>
<tr><td>40-49</td><td>Satisfactory</td><td>E</td><td>5</td></tr>
<tr><td>< 40</td><td>Fail</td><td>F</td><td>0</td></tr>
<tr><td>-</td><td>Absent</td><td>AB</td><td>0</td></tr>
</table>
Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters A+, A, B, C, D, E and F.
Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.</td></tr>
<tr><td>RB 15.2</td><td>Calculation of Semester Grade Points Average(SGPA) for semester:
The Performance of each student at the end of each semester is indicated in terms of SGPA.
The SGPA is calculated as below:
The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.
$SGPA = \Sigma (C_i \times G_i) / \Sigma C_i$
where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course</td></tr>
<tr><td>RB 15.3</td><td>Calculation of Cumulative Grade Points Average (CGPA) :
The CGPA is calculated as below:
The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.
$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$
where 'S_i' is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA/CGPA, the subjects in which the student is awarded Zero grade points will also be included.</td></tr>
<tr><td>RB 15.4</td><td>As per AICTE regulations, conversion of CGPA into equivalent percentage is as follows:
Equivalent Percentage = (CGPA – 0.75) x 10</td></tr>
<tr><td>RB 16.0</td><td>REVALUATION
As per the notification issued by the Controller of Examination, the student can submit the application for revaluation, along with the fee receipt for revaluation of her answer script(s) of theory course(s), if she is not satisfied with the Grade obtained. The Controller of Examination shall arrange for revaluation of those answer script(s).</td></tr>
<tr><td>RB 16.1</td><td>For Revaluation a new external examiner, other than the first examiner, shall re-evaluate the answer script(s). If there is any change in marks (below 15% of the maximum External marks) the highest of the two marks will be considered and if there is any change in marks (Equal or above 15% of the maximum External marks), the script will be evaluated by the third valuator. The marks of all the three valuators are compared and the average of two nearer marks will be awarded to the student.</td></tr>
<tr><td>RB 17.0</td><td>SUPPLEMENTARY EXAMINATIONS
Supplementary examinations shall be conducted twice in an academic year, along with regular semester end examinations.</td></tr>
</table>

<table>
<tr><td>RB 18.0</td><td colspan="2">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 in 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/-</td></tr>
<tr><td>RB 19.0</td><td colspan="2">BREAK IN STUDY
Student, who discontinues her studies for whatsoever may be the reason, can get readmission into appropriate semester of B.Tech. programme after break-in study only with the prior permission of the Principal of the College provided, such candidate shall follow the transitory regulations applicable to such batch in which she joins. An administrative fee of Rs.1000/- per year of break in study in addition to the prescribed tuition fee and special fee has to be paid by the candidate to condone her break in study if this break in study is not covered under GAP year facility.</td></tr>
<tr><td>RB 20.0</td><td colspan="2">AWARD OF DIVISION</td></tr>
<tr><td>RB 20.1</td><td colspan="2">After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. degree, she shall be placed in one of the following:</td></tr>
<tr><td rowspan="5"></td><td>CGPA secured from 160 credits
(121 credits for Lateral Entry Students)</td><td>Class Awarded</td></tr>
<tr><td>≥ 7.75</td><td>First Class with Distinction</td></tr>
<tr><td>≥ 6.75 to < 7.75</td><td>First Class</td></tr>
<tr><td>≥ 5.75 to < 6.75</td><td>Second Class</td></tr>
<tr><td>≥ 5.0 to < 5.75</td><td>Pass Class</td></tr>
<tr><td>RB 21.0</td><td colspan="2">BETTERMENT / IMPROVEMENT OF CUMULATIVE GRADE POINT AVERAGE</td></tr>
<tr><td>RB 21.1</td><td colspan="2">A candidate, after becoming eligible for the award of the Degree, may reappear for the external Examination in any of the theory courses as and when conducted, for the purpose of improving the CGPA. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the Degree, subject to fulfillment of Regulation RB 2.0.</td></tr>
<tr><td>RB 21.2</td><td colspan="2">However, this facility shall not be availed by a candidate to reappear either for Internal Examination or for Semester End Examinations in Practical courses (including Project Viva-Voce) and also for Semester End Examinations evaluated internally for the purpose of improvement.</td></tr>
<tr><td>RB 21.3</td><td colspan="2">Modified Grade Card and New Consolidated Grade Card shall be issued after incorporating new Grades and Credits.</td></tr>
<tr><td rowspan="2">RB 22.0</td><td colspan="2">ADVANCED SUPPLEMENTARY EXAMINATIONS</td></tr>
<tr><td colspan="2">Candidate(s), who fails in Theory or Lab courses of 4th year second semester, can appear for advanced supplementary examinations conducted within one month after declaration of the revaluation results. However, those candidates who fail in this advanced supplementary examination of IV year second semester shall appear for subsequent examination along with regular candidates conducted at the end of the respective academic year.</td></tr>
<tr><td>RB 23.0</td><td colspan="2">MALPRACTICES
The Principal/chief superintendent shall refer the cases of malpractices in internal assessment tests and Semester End Examinations to a Malpractice Enquiry Committee, constituted by him/her for the purpose. The Principal shall take necessary action, against the erring students based on the recommendations of the Committee as per JNTUK Malpractice regulations.</td></tr>
<tr><td>RB 24.0</td><td colspan="2">The physically challenged candidates who have availed additional examination time and a scribe during their Intermediate/EAMCET examinations shall be given similar concessions on production of relevant proof/documents.</td></tr>
</table>

RB 25.0	The students who are suffering from contagious diseases are not allowed to appear either internal or Semester end examinations with other students. A separate room will be allotted for such type of students.
RB 26.0	The students who participate in coaching/tournaments held at State/National/International levels through University / Indian Olympic Association during Semester end external examination period shall be promoted to subsequent semesters till the entire course is completed as per the guidelines of University Grants Commission Letter No. F. 1-5/88 (SPE/PES), dated 18-08-1994.
RB 27.0	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.
RB 28.0	The Academic Council, from time to time, may revise or amend or change the Regulations, schemes of examination and/or syllabi.
RB 29.0	**GAP YEAR:** Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship can take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at College level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.
RB 30.0	As per the demand of the industry, a specific elective can be offered in the department with the permission of the Principal and that can be ratified in the college academic committee. Minimum 20% of intake of students is compulsory for offering regular electives.
RB 31.0	All undergraduate students shall register for NCC/NSS activities and Community Service Project as per the Government and University norms. A student shall be required to participate in an activity for two hours in a week during second and third semesters. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.
RB 32.0	Environmental Science, Indian Constitution, etc are offered as mandatory courses for all branches. A student has to secure 40% of the marks allotted in the internal evaluation(conducted for 50 marks) for passing the course. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified. The students shall maintain the attendance similar to credit courses.
RB 33.0	All Open Electives are offered to students of all branches in general. However, a student shall choose an Open Elective from the list in such a manner that she has not studied the same course in any form during the Programme.
RB 34.0	A student shall be permitted to pursue upto a maximum of two elective courses under MOOCs during the Programme. Each of the courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to pursue and acquire a certificate for a MOOC course only from the organizations/agencies(like SWAYAM/NPTEL) approved by the BOS in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL/etc portal. During

	the course, the mentor monitors the student's assignment submissions given by SWAYAM/NPTEL/etc. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits given in curriculum only by submission of the certificate. In case, if student does not pass subjects registered through SWAYAM/NPTEL/etc, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL/etc in the next semester with the recommendation of HOD.
RB 35.0	Students shall undergo mandatory summer internships for a minimum of six weeks duration at the end of second and third year of the Programme. In the final semester, the student should mandatorily register and undergo internship and in parallel she should work on a project with well-defined objectives. Internship shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.
RB 36.0	There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain courses and the remaining one shall be a soft skills course. Skill oriented courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the skills learned. If the student completes skill oriented course at an external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (Record/Report: 15 marks and Viva-Voce: 35 marks) along with laboratory end examinations. Viva-Voce shall be conducted by the Departmental Committee consisting of Head of the Department and senior faculty member. There shall be no external examination for Skill oriented courses.
RB 37.0	Undergraduate Degree with Honors/Minor shall be issued by the University to the students who fulfill all the academic eligibility requirements for the B.Tech program and Honors/Minor program. The objective is to provide additional learning opportunities to academically motivated students.
RB 38.0	**Curricular Framework for Skill Oriented Courses**
RB 38.1	For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.
RB 38.2	Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.
RB 38.3	A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements. The list of such courses shall be included in the curriculum structure of each branch of Engineering, so as to enable the student to choose from the list.
RB 38.4	The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies as approved by the concerned BoS.
RB 38.5	The Board of studies of the concerned discipline of Engineering shall review the skill advanced courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand.
RB 38.6	If a student chooses to take a Certificate Course offered by industries/Professional

	bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the Board of studies.
RB 38.7	If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.
RB 38.8	A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks are to be approved by the College/Academic Council.
RB 39.0	**Curricular Framework for Honors Programme**
RB 39.1	Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline. The department offering Honors shall have at least one M. Tech in concerned stream. Institutions having at least two NBA accredited B.Tech/M.Tech programs can offer B.Tech(Honors). The Program should have valid NBA accreditation at the time of registration of the student for B.Tech (Honors).
RB 39.2	The students registered for Minor degree shall not be permitted to register for B. Tech (Honors). A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 CGPA upto the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 CGPA, her registration for Honors Programme stands cancelled and she shall continue with the regular Programme. An SGPA or CGPA in excess of 8.0 has to be maintained in the subsequent semesters in major as well as Honors degree without any backlogs in order to keep the Honors degree registration active. Should both the SGPA and CGPA fall below 8.0 at any point after registering for the Honors; the Honors degree registration will cease to be active.
RB 39.3	Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, she will be awarded B.Tech. (Honors) in Mechanical Engineering. The department concerned will determine required courses for award of Honor degree. The subjects in the Honor degree would be a combination of core (theory and lab) and some electives.
RB 39.4	In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Regular B.Tech Degree (i.e. 160 credits).
RB 39.5	Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing four courses from specified courses list in the department, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs(NPTEL/SWAYAM), which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies. If a student fails to complete a course offered in online/offline, she will not be permitted to continue the Honors degree. Transfer of credits from a particular Honors to regular B. Tech and vice-versa shall not be permitted.

RB 39.6	It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool/track shall be domain specific courses and advanced courses. Students can complete Honors degree courses either in the college or online from platforms like NPTEL/SWAYAM etc. The online NPTEL/SWAYAM subjects selected by a student shall be approved by concerned BOS. The duration of courses shall be a minimum of 14 weeks.
RB 39.7	The concerned BOS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criterion is not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS. Total number of seats offered for Honors degree shall be a maximum of 35% of sanctioned intake of major degree programme.
RB 39.8	Each pool/track can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BOS shall explore the possibility of introducing virtual labs for such courses with lab component.
RB 39.9	MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the College Academic Council. . The online NPTEL/SWAYAM subjects selected by a student shall be approved by concerned BOS.
RB 39.10	The concerned BOS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that she has not studied in any form during the Programme.
RB 39.11	If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into core or other electives; they will remain extra. These additional courses shall be mentioned in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as per the following: All the courses done under the dropped Honors will be shown in the transcript. None of the courses done under the dropped Honors will be shown in the transcript.
RB 39.12	Separate SGPA/CGPA shall be shown on semester and final transcripts of regular B. Tech and Honors. If a student failed in any registered course of the Honors, she shall not be eligible to continue the B.Tech Honors. However, the additional credits and grades thus far earned by the student shall be included in the grade card but shall not be considered to calculate the CGPA.
RB 39.13	Honors must be completed simultaneously with the regular degree program. A student cannot earn Honors after she has already earned bachelor’s degree. Honors degree shall not be awarded at any circumstances without completing the regular major B. Tech programme in which a student got admitted.
RB 39.14	**Registration Procedure:** The department offering the Honors will announce courses required before the start of the session. The interested students shall apply for the Honors degree to the HOD of the concerned department. In the event of any tie during the seat allotment for Honors, the concerned major degree department offering Honors shall conduct a test/interview on the prerequisite subjects of Honors and final decision shall be taken. The concerned department shall submit the final list of selected students to the Principal. Only selected students shall be permitted to register the courses for Honors degree. The selected students shall submit a joining letter to the Principal through the concerned HOD.

	The whole process of Honors should be completed within one week before the start of every session. The department offering Honors shall maintain the record of student pursing the Honors degree. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress. Students shall not be permitted to register for Honors degree after completion of VI semester.
RB 39.15	**Attendance Requirements:** The overall attendance in each semester of regular B.Tech courses and Honors courses shall be computed separately. A student shall maintain an overall attendance of 75% in all registered courses of Honors to be eligible for attending semester end examinations. However, condonation for shortage of attendance between 65-75% may be given as per University norms. A student detained due to lack of attendance in regular B. Tech programme shall not be permitted to continue Honors programme.
RB 39.16	A student shall report the concerned Principal of the college, if he/she is not interested to pursue/continue the Honors degree programme. If the student wishes to withdraw/change the registration of subject/course, she shall inform the same to advisor/mentor, subject teacher, HOD of parent department and Principal within two weeks after registration of the course. Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for Honors. If the Honors subjects are the same as regular or elective subjects studied as part of curriculum then students are not allowed to choose such Honors subjects. There is no fee for registration of subjects for Honors degree programme offered in offline.
RB 39.17	**Examinations:** (a) The examination for the Honors degree courses offered in offline shall be conducted along with regular B. Tech programme. (b) The examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B. Tech courses. (c) A separate transcript shall be issued for the Honors subjects passed in each semester. (d) There is no supplementary examination for the failed subjects in an Honors degree programme. (e) Students shall pay the examination fee for the Honors degree courses.
RB 40.0	**Curricular Framework for Minor Programme:**
RB 40.1	a)Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in Minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, she will get Major degree in Mechanical Engineering with Minor degree in Civil Engineering. b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Science track, IOT track, Machine Learning track etc.
RB 40.2	The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the Minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science(DS), Robotics, Electric vehicles, VLSI etc.
RB 40.3	The list of disciplines/branches eligible to opt for a particular industry relevant Minor specialization shall be clearly mentioned by the respective BOS.
RB 40.4	There shall be no limit on the number of programs offered under Minor. The

	University/Institution can offer Minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program. The department concerned will determine the required courses for award of Minor. The subjects in Minor program would be a combination of mostly core and some electives.
RB 40.5	The concerned BOS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS. Total number of seats offered for a Minor programme shall be a maximum of 35% of sanctioned intake of major degree programme.
RB 40.6	The students registered for B. Tech (Honors) shall not be permitted to register for Minor. A student shall be permitted to register for Minor program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired CGPA of 7.75 or above upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire CGPA of 7.75 upto 3rd semester or failed in any of the courses, her registration for Minor program shall stand cancelled. An SGPA or CGPA in excess of 7.75 has to be maintained in the subsequent semesters in major as well as Minor without any backlogs in order to keep the Minor registration active. Should both the SGPA and CGPA fall below 7.75 at any point after registering for the Minor; the Minor registration will cease to be active. A student registered for Minor in a discipline must register and pass in all subjects with a minimum GPA of 7.75 that constitute requirement for award of Minor.
RB 40.7	A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits). If a student fails to complete a course offered in online/offline, she will not be permitted to continue the Minor degree. Transfer of credits from a particular Minor to regular B. Tech and vice-versa shall not be permitted.
RB 40.8	Out of the 20 Credits, 16 credits(with four courses, each carrying 4 credits) shall be earned by undergoing specified courses listed by the concerned BOS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that she has not studied in any form during the Programme. Students can complete Minor courses either in the college or in online from platforms like NPTEL/SWAYAM etc. The online NPTEL/SWAYAM subjects selected by a student shall be approved by concerned BOS. The duration of courses shall be a minimum of 14 weeks.
RB 40.9	In addition to the 16 credits, students must pursue at least 2 courses which shall be domain specific each with 2 credits through MOOCs(NPTEL/SWAYAM) to earn the remaining 4 credits. The courses shall be a minimum of 8/12 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade will be assigned as decided by the university/academic council.
RB 40.10	Student can opt for the Industry relevant Minor specialization as approved by the concerned departmental BOS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of

	the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.
RB 40.11	A committee should be formed at the level of College/ department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BOS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.
RB 40.12	If a student drops (is terminated) from the Minor program, the additional credits so far earned cannot be converted into core or other electives; they will remain extra. These additional courses shall be mentioned in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as per the following: All the courses done under the dropped Minor will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
RB 40.13	Separate SGPA/CGPA shall be shown on semester and final transcripts of regular B. Tech and Minor. If a student failed in any registered course of the Minor, she shall not be eligible to continue the B.Tech Minor. However, the additional credits and grades thus far earned by the student shall be included in the grade card but shall not be considered to calculate the CGPA.
RB 40.14	Minor must be completed simultaneously with the regular degree program. A student cannot earn the Minor after she has already earned bachelor's degree. Minor shall not be awarded at any circumstances without completing the regular major B. Tech programme in which a student got admitted.
RB 40.15	**Registration Procedure:** The department offering the Minor will announce specialization and courses before the start of the session. The interested students shall apply through the HOD of her parent department. In the event of any tie during the seat allotment for Minor, the concerned major degree department offering Minor shall conduct a test/interview on the prerequisite subjects of Minor and final decision shall be taken. The concerned department will submit the final list of selected students to the Principal. Only selected students shall be permitted to register the courses for Minor. The selected students shall submit a joining letter to the Principal through the concerned HOD offering the Minor. The student shall inform same to the HOD of her parent department. The whole process of Minor should be completed within one week before the start of every session. Both parent department and department offering Minor shall maintain the record of student pursing the Minor. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress. Students shall not be permitted to register for Minor degree after completion of VI semester. The students are permitted to opt for only a single Minor course in her entire tenure of B.Tech.
RB 40.16	**Attendance Requirements:** The overall attendance in each semester of regular B.Tech courses and Minor courses shall be computed separately. A student shall maintain an overall attendance of 75% in all registered courses of Minor to be eligible for attending semester end examinations. However, condonation for shortage of attendance between 65-75% may be given as per University norms. A student detained due to lack of attendance in regular B. Tech programme shall not be permitted to continue Minor programme.
RB 40.17	A student shall report the concerned Principal of the college, if he/she is not interested to

	pursue/continue the Minor degree programme. If the student wishes to withdraw/change the registration of subject/course, she shall inform the same to advisor/mentor, subject teacher, HODs of Minor department and parent department and Principal within two weeks after registration of the course. Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for Minor. If some of the Minor subjects are offered as regular subjects as part of students' parent department curriculum then students are not allowed to choose such Minor degree. They have to choose some other department Minor degree. There is no fee for registration of subjects for Minor degree programme offered in offline.
RB 40.18	**Examinations:** (a)The examination for the Minor courses offered in offline shall be conducted along with regular B. Tech programme. (b)The examinations (internal and external) and evaluation procedure of Minor courses offered in offline is similar to regular B. Tech courses. (c)A separate transcript shall be issued for the Minor subjects passed in each semester. (d) There is no supplementary examination for the failed subjects in a Minor programme. (e) Students shall pay the examination fee for the Minor degree courses.
RB 41.0	Withholding of Results If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

Guidelines for Community Service Project

Introduction

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

Objectives

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

1. To sensitize the students to the living conditions of the people who are around them.
2. To help students to realize the stark realities of the society.
3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability.
4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
6. To help students to initiate developmental activities in the community in coordination with public and government authorities.

7. To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

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

Procedure

1. A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
2. The Community Service Project is a twofold one –
   a. First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
   b. Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
      - Agriculture
      - Health
      - Marketing and Cooperation
      - Animal Husbandry
      - Horticulture
      - Fisheries
      - Sericulture
      - Revenue and Survey
      - Natural Disaster Management
      - Irrigation
      - Law & Order
      - Excise and Prohibition
      - Mines and Geology
      - Energy

- Internet
- Free Electricity
- Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

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

Personal Outcomes

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

Social Outcomes

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

Career Development

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

Relationship with the Institution

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

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

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

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

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

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

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

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the

responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilization of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complementing the community service project, the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes is;
Programmes for School Children

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

Programmes for Women Empowerment

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

General Camps

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

Programmes for Youth Empowerment

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

Common Programmes

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
    - i. Agriculture
    - ii. Health
    - iii. Marketing and Cooperation
    - iv. Animal Husbandry
    - v. Horticulture
    - vi. Fisheries
    - vii. Sericulture
    - viii. Revenue and Survey
    - ix. Natural Disaster Management
    - x. Irrigation
    - xi. Law & Order
    - xii. Excise and Prohibition

xiii. Mines and Geology
xiv. Energy

Role of Students:

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

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. **Preliminary Survey (One Week)**
   a. A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
   b. A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.)
   c. The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.
2. ***Community Awareness Campaigns (Two Weeks)***
   Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.
3. ***Community Immersion Programme (Four Weeks)***
   Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.
4. ***Community Exit Report (One Week)***
   During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.
   Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

@@@@@@@

MALPRACTICES GUIDELINES

Disciplinary Action for Improper Conduct in Examinations

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which she is appearing but has not made use of. (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the examination hall in respect of any matter.	Expulsion of all the candidates involved from the examination hall and cancellation of the performance in that subject only. In case of an outsider, he will be handed over to the police and a case will be registered against him
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate will be seized and cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate/Person who has impersonated shall be expelled from examination hall. The candidate will also be debarred and forfeits the course. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course of such candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent / Asst. Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester / year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the examination 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 will also be debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate will also forfeit his/her course.
9.	If the student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college shall be expelled 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 will also forfeit the course. Person(s) who do not belong to the College will be

		handed over to police and a police case will be registered against them.
10.	Comes in a drunken/intoxicated condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators
Punishments to the candidates as per the above guidelines.

* * * * *

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

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

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Years	+	Rs. 50,000/-

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN:: BHIMAVARAM (AUTONOMOUS)
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Demonstrate employability skills and leadership qualities to serve the society
PEO2	Achieve personal and professional success with awareness and commitment to their ethical and social responsibilities
PEO3	Improve professional competence through life-long learning including higher education and research

PROGRAM OUTCOMES (POs)

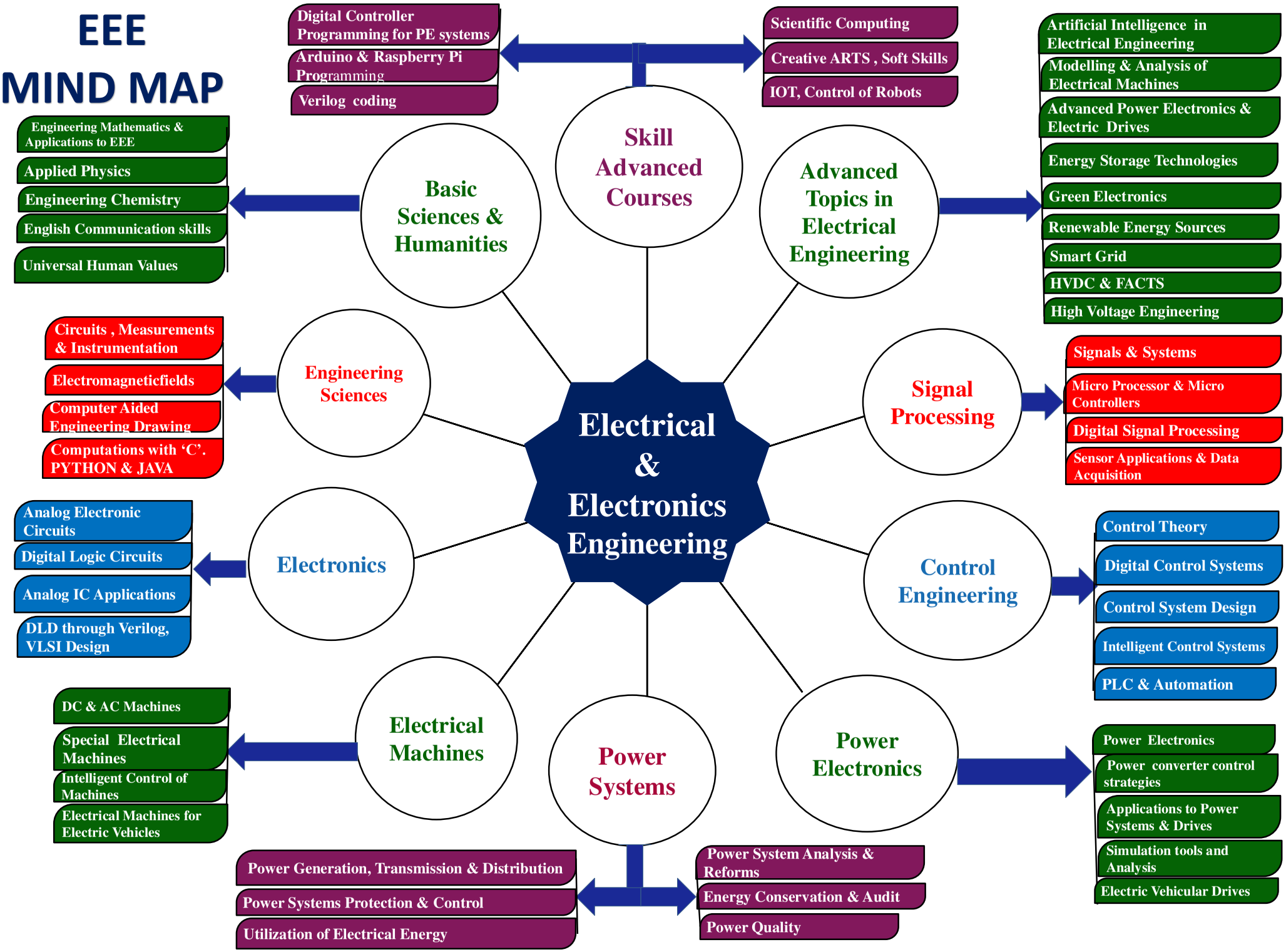
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**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
PO4	**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
PO5	**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
PO6	**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
PO7	**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

PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
PO10	**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.
PO11	**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
PO12	**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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	Ability to enhance living standards of disabled people by designing appropriate products with the help of technology.
PSO2	Competence to explore, analyze and solve problems related to power electronic systems.

EEE MIND MAP


Electrical & Electronics Engineering
Skill Advanced Courses
Digital Controller Programming for PE systems
Arduino & Raspberry Pi Programming
Verilog coding
Scientific Computing
Creative ARTS , Soft Skills
IOT, Control of Robots
Basic Sciences & Humanities
Engineering Mathematics & Applications to EEE
Applied Physics
Engineering Chemistry
English Communication skills
Universal Human Values
Advanced Topics in Electrical Engineering
Artificial Intelligence in Electrical Engineering
Modelling & Analysis of Electrical Machines
Advanced Power Electronics & Electric Drives
Energy Storage Technologies
Green Electronics
Renewable Energy Sources
Smart Grid
HVDC & FACTS
High Voltage Engineering
Engineering Sciences
Circuits , Measurements & Instrumentation
Electromagneticfields
Computer Aided Engineering Drawing
Computations with 'C'. PYTHON & JAVA
Signal Processing
Signals & Systems
Micro Processor & Micro Controllers
Digital Signal Processing
Sensor Applications & Data Acquisition
Electronics
Analog Electronic Circuits
Digital Logic Circuits
Analog IC Applications
DLD through Verilog, VLSI Design
Control Engineering
Control Theory
Digital Control Systems
Control System Design
Intelligent Control Systems
PLC & Automation
Electrical Machines
DC & AC Machines
Special Electrical Machines
Intelligent Control of Machines
Electrical Machines for Electric Vehicles
Power Systems
Power Generation, Transmission & Distribution
Power Systems Protection & Control
Utilization of Electrical Energy
Power System Analysis & Reforms
Energy Conservation & Audit
Power Quality
Power Electronics
Power Electronics
Power converter control strategies
Applications to Power Systems & Drives
Simulation tools and Analysis
Electric Vehicular Drives

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)
BHIMAVARAM - 534202
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
Course Structure - R22
(With effect from 2022-2023)

I Year - I Semester

S. No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	BS	UGBS1T0122	Mathematics – I	3	-	-	3	30	70	100
2	BS	UGBS1T0322	Engineering Chemistry	3	-	-	3	30	70	100
3	HSS/ES	UGEE1T0222	Electrical Circuit Analysis - I	3	-	-	3	30	70	100
4	ES	UGEE1T0322	Electrical Power Generation	3	-	-	3	30	70	100
5	ES	UGCS1T0222	Problem Solving with C	3	-	-	3	30	70	100
6	HSS/ES LAB	UGME1P0322	Computer Aided Engg. drawing Lab	-	-	3	1.5	15	35	50
7	BS LAB	UGBS1P0822	Engineering Chemistry Lab	-	-	3	1.5	15	35	50
8	ES LAB	UGCS1P0322	Problem Solving with 'C' Lab	-	-	3	1.5	15	35	50
			Total	**15**	**0**	**9**	**19.5**	**195**	**455**	**650**

I Year - II Semester

S. No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	BS	UGBS2T0122	Mathematics–II	3	-	-	3	30	70	100
2	BS	UGBS2T0222	Applied Physics	3	-	-	3	30	70	100
3	HSS/ES	UGBS2T0522	English	3	-	-	3	30	70	100
4	ES	UGCS2T0222	Python Programming	3	-	-	3	30	70	100
5	ES	UGEE2T0122	Electrical Machines - I	3	-	-	3	30	70	100
6	ES LAB	UGCS2P0422	Python Programming Lab	-	-	3	1.5	15	35	50
7	BS LAB	UGBS2P0622	Applied Physics Lab	-	-	3	1.5	15	35	50
8	HSS/ES LAB	UGBS2P0922	English Communication Skills	-	-	3	1.5	15	35	50
9	MC	UGBS2A1022	Indian Constitution	2	-	-	-	-	-	-
			Total	**17**	**0**	**9**	**19.5**	**195**	**455**	**650**

II Year - I Semester

S. No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	BS	UGBS3T0522	Numerical Methods and Complex Variables	3	-	-	3	30	70	100
2	PC	UGEE3T0122	Electrical Circuit Analysis -II	3	-	-	3	30	70	100
3	PC	UGEE3T0222	Electrical Machines-II	3	-	-	3	30	70	100
4	PC	UGEE3T0322	Digital Logic Circuits	3	-	-	3	30	70	100
5	PC	UGEE3T0422	Analog Electronics	3	-	-	3	30	70	100
6	PC LAB	UGEE3P0522	Electrical Circuits Lab	-	-	3	1.5	15	35	50
7	PC LAB	UGEE3P0622	Electrical Machines-I Lab	-	-	3	1.5	15	35	50
8	PC LAB	UGEE3P0722	Electrical & Mechanical Lab	-	-	3	1.5	15	35	50
9	SOC	UGBS3C0122	Arts	1	-	2	2	50	-	50
10	MC	UGBS3A0322	Environmental Science	2	-	-	-	-	-	-
			Total	**18**	**0**	**11**	**21.5**	**245**	**455**	**700**

II Year - II Semester

S. No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	ES	UGEE4T0122	Transmission & Distribution	3	-	-	3	30	70	100
2	BS/PC	UGBS4T0322	Probability and Statistics	3	-	-	3	30	70	100
3	PC	UGEE4T0222	Analog Integrated Circuits	3	-	-	3	30	70	100
4	PC	UGEE4T0322	Power Electronics	3	-	-	3	30	70	100
5	HSS	UGBS4T0122	Universal Human Values	3	-	-	3	30	70	100
6	ES/PC LAB	UGEE4P0422	Analog Electronics Lab	-	-	3	1.5	15	35	50
7	PC LAB	UGEE4P0522	Electrical Machines-II Lab	-	-	3	1.5	15	35	50
8	PC LAB	UGEE4P0622	Digital Logic Circuits Lab	-	-	3	1.5	15	35	50
9	SOC	UGEE4K0722	Scientific Computing Lab	1	-	2	2	50	-	50
				16	**0**	**11**	**21.5**	**245**	**455**	**700**
Internship 2 Months (Mandatory) during Summer Vacation										
Honors/Minor Course (4 Credits)										

III Year - I Semester

S. No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PC	UGEE5T0122	Electric Vehicular Drives	3	-	-	3	30	70	100
2	PC	UGEE5T0222	Electrical Measurements & Instrumentation	3	-	-	3	30	70	100
3	PC	UGEE5T0322	Control Systems	3	-	-	3	30	70	100
4	OE-I/JOE-I	UGBS5T0122	Employability Skills	2	-	2	3	30	70	100
5	PE-I	UGEE5T0422	Foundations in Computer Science	3	-	-	3	30	70	100
		UGEE5T0522	Special Electrical Machines							
		UGEE5T0622	Signals & Systems							
		UGEE5T0722	Utilization of Electrical Energy							
		UGEE5T0822	Digital Logic Design through Verilog							
6	PC LAB	UGEE5P0922	Power Electronics & Drives Lab	-	-	3	1.5	15	35	50
7	PC LAB	UGEE5P1022	Electrical Measurements & Instrumentation Lab	-	-	3	1.5	15	35	50
8	SOC	UGEE5K1122	Digital Systems Design and Advanced Control Systems Lab	1	-	2	2	50	-	50
9	MC	UGMB5A0122	IPR & Patents	2	-	-	-	-	-	-
10	Internship	UGEE5I1322	Summer Internship (after second year)	-	-	-	1.5	50	-	50
			Total	**17**	**0**	**10**	**21.5**	**280**	**420**	**700**
Honors/Minor Course (4 Credits)										

III Year - II Semester

S. No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PC	UGEE6T0122	Power System Analysis	3	-	-	3	30	70	100
2	PC	UGEE6T0222	Power System Protection	3	-	-	3	30	70	100
3	PC	UGEE6T0322	Micro Processors & Micro Controllers	3	-	-	3	30	70	100
4	PE-II	UGEE6T0422	Optimization Techniques	3	-	-	3	30	70	100
		UGEE6T0522	Digital Control Systems							
		UGEE6T0622	Digital Signal Processing							
		UGEE6T0722	Advanced Power Electronics							
		UGEE6T0822	VLSI Design							
5	OE-II/JOE-II	UGEE6T0922	**JOE-II Introduction to Machine Learning**	2	-	2	3	30	70	100
6	PC LAB	UGEE6P1022	Power Systems Lab	-	-	3	1.5	15	35	50
7	PC LAB	UGEE6P1122	Control Systems Lab	-	-	3	1.5	15	35	50
8	PC LAB	UGEE6P1222	Micro Processors & Micro Controllers lab	-	-	3	1.5	15	35	50
9	SOC	UGEE6K1322	Engineering Computaional Project	1	-	2	2	50	-	50
10	MC	UGBS6A0222	Essence of Indian Traditional Knowledge	2	-	-	-	-	-	-
			Total	**17**	**0**	**13**	**21.5**	**245**	**455**	**700**
Internship 2 Months (Mandatory) during Summer Vacation										
Honors/Minor Course (4 Credits)										

IV Year - I Semester

S. No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PE-III	UGEE7T0122	Power System Operation & Control	3	-	-	3	30	70	100
		UGEE7T0222	Power Converter Control strategies							
		UGEE7T0322	Control Systems Design							
		UGEE7T0422	Green Energy and Control							
		UGEE7T0522	High Voltage Engineering							
2	PE-IV	UGEE7T0622	Electrical Distribution Systems	3	-	-	3	30	70	100
		UGEE7T0722	Hybrid Electric Vehicles							
		UGEE7T0822	Wind and Solar Energy Systems							
		UGEE7T0922	Power Quality							
		UGEE7T1022	Data Science							
3	PE-V	UGEE7T1122	Energy Audit, Conservation & Management	3	-	-	3	30	70	100
		UGEE7T1222	Smart Grid							
		UGEE7T1322	Programmable Logic Controllers & Applications							
		UGEE7T1422	Energy Storage Technologies							
		UGEE7T1522	Modeling and Analysis of Electrical Machines							
4	OE-III/ JOE-III	JOE-III UGEE7T1622	Battery Management System	2	-	2	3	30	70	100
5	OE-IV/ JOE-IV	OE-IV UGCS0T1422	Software Engineering	2	-	2	3	30	70	100
		JOE-IV UGEE7T1722	Artificial Intelligence in Electrical Engineering							
6	HSSE	UGMB7T0122	Management Science	3	-	-	3	30	70	100
7	SOC	UGEE7K1822	Digital Controller Programming for Power Electronic Systems lab	1	-	2	2	50	-	50
		UGEE7O1922	Certification Course*							
8	Internship	UGEE7I2022	Industrial/Research Internship(after third year)	-	-	-	3	50	-	50
			Total	**17**	**0**	**6**	**23**	**280**	**420**	**700**
Honors/Minor Course (4 Credits)										

Note: * Any certificate course offered by industries/Professional Bodies/APSSDC or any other accredited bodies as approved by the BoS.

IV Year - II Semester

S. No.	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	Major Project	UGEE8J0122	Major Project / Internship (6 Months)	-	-	20	10	60	140	200
2	Seminar	UGEE8S0222	Seminar	-	2	-	2	50	-	50
			Total	**0**	**2**	**20**	**12**	**110**	**140**	**250**

L – Lectures, T – Tutorials, P – Practicals, C – Credits, IM – Internal Marks, EM – External Marks, TM – Total Marks

BS - Basic Science, HSS - Humanities & Social Science, ES - Engineering Science, MC - Mandatory Course, PC - Professional Core, SOC - Skill Oriented Course, OE/JOE - Open Elective/Job Oriented Elective, PE - Professional Elective, HSSE - Humanities & Social Science Elective

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)
BHIMAVARAM – 534202
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Course Structure – R22
(With effect from 2022-2023)

Open Electives

The following courses are offered to the students of other departments.

S. No.	Course Code	Course Title
1	UGEE0T0122	Energy Studies
2	UGEE0T0222	Solar Energy Appliances
3	UGEE0T0322	Energy Audit and Conservation
4	UGEE0T0422	Battery Technologies
5	UGEE0T0522	Industrial Electronics
6	UGEE0T0622	Electrical Machines for EV's
7	UGEE0T0722	Sensors & Data Acquisition
8	UGEE0T0822	PLC & Applications
9	UGEE0T0922	Scientific Computing with MATLAB
10	UGEE0T1022	AI Techniques

Note: Each department will notify the list of Open Electives to be offered at the time of Course registration.

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN:: BHIMAVARAM
(AUTONOMOUS)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
Course Structure – R22
(With effect from AY: 2022-23)

HONORS (for EEE Students)

S.No.	Course Code	Course Title	L	T	P	C	Pre Requisite
Track 1 (Electrical Machines)							
1	UGEE4H0122	Advanced Network Analysis	3	1	0	4	M-I, M-II, ECA
2	UGEE5H0122	Electrical Machine Design	3	0	2	4	EM-I, EM-II
3	UGEE6H0122	Modeling and Analysis of Electric Machines	3	1	0	4	EM-I,EM-II
4	UGEE7H0122	Electrical Machines for Electric Vehicles	3	1	0	4	SEM
Track 2 (Power Electronics)							
1	UGEE4H0222	Renewable Energy Sources	3	1	0	4	Engineering Physics
2	UGEE5H0222	Power Semiconductor Devices	3	1	0	4	Analog Electronics
3	UGEE6H0222	Control Strategies for Power Electronic Converters	3	1	0	4	CS, ACS
4	UGEE7H0222	Electric Drives for Electric Vehicles	3	1	0	4	CS, ACS, DCS
Track 3 (Power Systems)							
1	UGEE4H0322	Energy Audit Demand Side Management	4	0	0	4	---
2	UGEE5H0322	Power System Reforms	4	0	0	4	PSGT, EA&DM
3	UGEE6H0322	Distribution Automation	4	0	0	4	PSGT
4	UGEE7H0322	Advanced Power System Protection	3	1	0	4	PSP
Track 4 (Control Systems)							
1	UGEE4H0422	Principles of Signals & Systems	3	0	2	4	M-I
2	UGEE5H0422	Linear Systems Theory	4	0	0	4	CS
3	UGEE6H0422	Optimal Control Systems	3	1	0	4	CS
4	UGEE7H0422	Process Dynamics & Control	3	1	0	4	CS
MOOCs							
1	UGEE0H3522	MOOC1	2	-	-	2	-
2	UGEE0H3622	MOOC2	2	-	-	2	-

Note: Students can choose any 4 courses in the interested track in addition to the 2 MOOC courses to get the Honors degree.

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN:: BHIMAVARAM
(AUTONOMOUS)
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Course Structure – R22
(With effect from 2022-2023)

Minor (For other Departments)

S.No.	Course Code	Course Title	L	T	P	C	Pre Requisite
TRACK-1							
1	UGEE4M0122	Fundamentals of Electrical Engineering	3	1	0	4	-
2	UGEE5M0122	Power Engineering	3	1	0	4	-
3	UGEE6M0122	Control System Engineering	4	0	0	4	-
4	UGEE7M0122	Power Electronics	3	1	0	4	-
TRACK-2							
1	UGEE4M0222	Power Electronics for Electric Vehicles	3	1	0	4	BEEE
2	UGEE5M0222	Electric Drives for Electric Vehicles	3	1	0	4	BEEE
3	UGEE6M0222	Energy Storage and Battery Management Systems	4	0	0	4	---
4	UGEE7M0222	Electric & Hybrid Vehicles	3	1	0	4	PECEV, EDEV & ESBMS
TRACK-3							
1	UGEE4M0322	Signal Systems & Circuits	3	1	0	4	-
2	UGEE5M0322	Linear Control systems	3	1	0	4	SS&C
3	UGEE6M0322	Advanced Control Theory	3	1	0	4	CS
4	UGEE7M0322	Digital Control Systems	3	1	0	4	CS, SS&C
TRACK-4							
1	UGEE4M0422	Renewable Sources of Energy	3	1	0	4	-
2	UGEE5M0422	Energy Conservation & Audit	3	1	0	4	-
3	UGEE6M0422	Utilization of Electrical Energy	3	1	0	4	BEE / BEEE
4	UGEE7M0422	Power Quality	3	1	0	4	BEE / BEEE
MOOCs							
1	UGEE0M3522	MOOC1	2	-	-	2	-
2	UGEE0M3622	MOOC2	2	-	-	2	-

Note: Non EEE Students can choose any 4 courses in the above list in addition to the 2 MOOC courses to get the Minor degree in EEE.

I YEAR
I SEMESTER

MATHEMATICS-I

Subject Code: UGBS1T0122	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of Matrices, Differentiation and Integration

Course Objectives:

- Prepare students to learn the concepts of rank of a matrix, Eigen values, Eigen vectors.
- Familiarize students with analytical methods to solve ordinary differential equations.
- Assist the students to learn the concepts of partial differentiation.
- Gain knowledge of infinite series expansions of various real valued functions.

Syllabus:

Unit-I: (10 Hours)

Linear Systems of Equations

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations - solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method.

Application: Finding the current in an Electrical Circuit by Gauss elimination method

Unit-II: (10 Hours)

Eigen Values and Eigen Vectors

Linear Transformation and Orthogonal Transformations, Eigen values and Eigen vectors and their properties.

Diagonalization of matrices by Similarity and Orthogonal transformations, Cayley-Hamilton Theorem (without proof).

Application : Finding inverse and powers of a matrix by Cayley-Hamilton Theorem

Unit-III: (10 Hours)

Ordinary Differential Equations of First Order and First Degree

Exact, Reducible to exact equations, Linear and Bernoulli's equations.

Applications: Orthogonal Trajectories, Newton's Law of Cooling, Law of Natural Growth and Decay.

Unit-IV: **(10 Hours)**

Ordinary Differential Equations of Higher Order

Second and Higher order linear differential equations with constant coefficients, Non-Homogeneous terms of the type $\sin ax, \cos ax, e^{ax}$, polynomials in x, $e^{ax}V(x)$ and $xV(x)$. Linear Differential equations with variable coefficients: Cauchy-Euler and Legendre's Equations.

Unit-V: **(12 Hours)**

Partial Differentiation & Mean Value Theorems

Partial Differentiation, Total derivative; Jacobian, Functional dependence, Maxima, minima of functions of two and three variables, Lagrange method of undetermined multiplier.

Taylor's and Maclaurin's theorems with remainders (Without Proof), Taylor's and Maclaurin's series.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Determine the rank, inverse, powers of a matrix and apply matrix techniques to model and solve system of linear equations (L4)

CO2: Illustrate Eigen values, Eigen vectors, properties and diagonalization of a given matrix (L2)

CO3: Apply appropriate analytical technique to model and solve a given differential equation (L3)

CO4: Apply the concepts of Partial differentiation to Jacobians, Extrema of several variable functions and to construct the Taylor's, Maclaurin's series from generalized mean value theorem (L3)

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015.

2.Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

REFERENCE BOOKS:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, 2002.
6. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2013.

ENGINEERING CHEMISTRY

Subject Code: UGBS1T0322	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge on Chemistry

Course objectives:

- To provide basic building blocks of Engineering by coverage of advanced chemistry topics.
- To make the students learn about importance of nano and material chemistry.
- To introduce the basic principles of batteries, fuel cell construction and the importance of advanced polymers.

Syllabus:

UNIT-I: (15 Hours)

COMPUTATIONAL CHEMISTRY& CHEMINFORMATICS

Computational chemistry: Introduction, Molecular Machines- Molecular switches, Molecular motors, characteristics of molecular machines, Artificial molecular machines-preparation of Rotaxanes and Catenanes and applications, linear motions in rotaxanes, molecular Elevators, Acid-Base catalysed molecular machines, Prototypes (Materialisation).

Cheminformatics: Docking- Kinds, approaches and Types, factors effecting docking, Key stages and applications, drug and receptor interaction, polarity of the molecule.

UNIT- II: (10 Hours)

CHEMIELECTRONICS

Battery Chemistry – Introduction, Primary batteries-Zn/NH_4Cl, Alkaline battery and Hg/HgO Battery. Secondary batteries- Mercury cell, NiMH, Li–ion batteries. Fuel cells- H_2- O_2 fuel cells, Methanol – Oxygen fuel cell working and applications.

PCB'S-Electro plating, Electroless plating-Ni, Cu. Applications-Manufacturing of printed circuit boards by Electroless plating, Types of PCB'S- single sided, double sided, multilayered.

Liquid crystals- Introduction, types-Thermotropic and lyotropic, structure, and Applications- Working of Liquid crystal display (LCD).

UNIT-III: (10 Hours)

PHOTO AND LIGHT RESPONSIVE COMPOUNDS

Sensors- Introduction, Characteristics of sensors. Types-Internal, external, active and passive. Electrochemical sensors (to detect the Carbon monoxide in the atmosphere), Biosensors - Characteristics and working of Glucose biosensor (Glucose monitoring in blood).

Storage devices- Introduction, primary and secondary storage devices, working of floppy, CD, Hard disk, Pen drive and applications.

UNIT- IV: (7 Hours)

NON-CONVENTIONAL ENERGY RESOURCES

Solar Energy – Introduction, Types of Solar cells – Concentrating and Non-concentrating solar cells. Harnessing of solar energy by solar Fresnel's, and PV cells. Construction, Working and Types of PV cells.

Hydropower - Working of hydro electrical power plant, Geothermal energy, Tidal power and, ocean thermal energy conversion (OTEC).

UNIT- V: (8 Hours)

MATERIAL CHEMISTRY

Composite materials- Constituents of composites, classification based on Primary phase and secondary phase, Types - CFRP, GFRP & its applications.

Nano materials- Classification, Preparation, Properties and applications of Carbon Nano materials.

Advanced polymers- Preparation of poly lactic acid, PHBV, Polyvinyl alcohol, Properties and applications of Biodegradable polymers, conducting polymers-Classification and application.

Super conductors-Introduction, Type-I&II Super conductors, preparation of the 1-2-3-super conducting pellet ($YBa_2Cu_3O_7$-x) and its applications.

Course Outcomes:

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

CO1: Evaluate applicability of computational chemistry in Engineering. (L5)

CO2: Make use of the concepts in quantum chemistry and molecular mechanics for drug modelling. (L3)

CO3: Apply the working principles of batteries, fuel cells in Engineering. (L3)

CO4: Distinguish types of sensors based on the working principle. (L4)

CO5: Analyze various types of conventional and non- conventional energy resources. (L4)

CO6: Identify properties and applications of industrially important advanced materials. (L3)

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	3	-	-	-	-	3
CO4	-	-	-	-	-	3	3	-	-	-	-	3
CO5	-	-	-	-	-	3	3	-	-	-	-	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3

TEXT BOOKS:

1. Text book of Engineering Chemistry by Jain & Jain. Dhanpat Rai Publishing Company, 16th edition, 2015.
2. A Text book of Engineering Chemistry by Shashi Chawla. Dhanpat Rai Publications, 3rd edition, 2013.
3. A text book of Organic Chemistry by Morrison and Boyd, 7th edition, Pearson publications.
4. Computational Chemistry by Dr. Parashuram mishra, Jagadamba publications.

REFERENCE BOOKS:

1. A Text book of Engineering Chemistry by S.S.Dara, S.Chand & Company Ltd., 12th edition. 2010.
2. A Text book of Engineering Chemistry Shika Agarwal, Cambridge, 2015.
3. A text book of Engineering Chemistry by Rath, Rama Devi, Reddy, Cengage Learning Indian pvt. Ltd., 2016.
4. A Text book of Chemistry, principles and applications by M.J.sienko and R.A.Plane.
5. Fundamentals of molecular spectroscopy by C.N.Banwell.
6. A Text book of Physical chemistry by P.W. Atkins.
7. A Text book of Organic Chemistry: structure and function by K.P.C.Volhardt and N.E. Schore, 5th edition.
8. A text book of Inorganic Chemistry by Dr.Wahid, U.Malik, S.Chand publication, Revised edition.
9. Computational Chemistry by Errol G. Lewis 2nd edition, Springer publications.
10. Essentials of Computational Chemistry Christopher J Cramer 2nd edition, Wiley.

ELECTRICAL CIRCUIT ANALYSIS-I

Subject Code: UGEE1T0222	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Engineering Physics, Mathematics

Course Objectives: This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of AC & DC circuits.

Syllabus:

UNIT –I: (9 Hours)

Introduction to Electrical Circuits

Passive components and their V-I relations. Sources (dependent and independent) - Kirchhoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta- to-star transformation). Source transformation technique.

UNIT –II: (9 Hours)

Method of Analysis

Nodal Analysis, Nodal Analysis with voltage sources, Mesh Analysis with current sources, Nodal Vs mesh analysis Techniques- Numerical problems.

UNIT –III: (8 Hours)

A. C Fundamentals

Periodic waveforms (determination of rms, average value, peak factor, and form factor). Concept of phase angle and phase difference – Waveforms and phasor diagrams for lagging, leading networks.

Complex and polar forms of representations. Instantaneous and average powers, Apparent power and power factor- complex power. Introduction to three phase systems (relationship between Line and phase quantities in star and delta connections)

UNIT –IV: (9 Hours)

Sinusoidal steady state Analysis

Steady state analysis of R, L and C circuits. Power Factor and its significance, real, reactive power and apparent power, waveform of instantaneous power and complex power, Extension of node and mesh analysis to AC networks, Numerical problems on sinusoidal steady state analysis- Series & parallel resonance.

UNIT- V: **(8 Hours)**

Network Theorems

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Milliman's theorem- Application of network theorems on AC and DC circuits (Numerical problems)

Course Outcomes:

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

CO1: Ability to apply the fundamentals of electrical circuits to solve various electrical networks.(L3)

CO2: Apply the knowledge of AC fundamentals to analyze single-phase AC circuits of different configurations.(L3)

CO3: Simplify electrical networks using network theorems.(L4)

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	3

TEXTBOOKS:

1. "Engineering Circuit Analysis" by William Hayt and Jack E. Kemmerley, 6th edition, McGraw Hill Company,

2. "Network Analysis" by Van Valkenburg, 3rd edition, PHI Learning, 2006.

3. "Fundamentals of Electric circuits" by C. K. Alexander and M. N. O. Sadiku, 5th edition, Mc Graw hill Publishers, 2013.

REFERENCE BOOKS:

1. "Circuit Theory (Analysis and Synthesis) by A. Chakrabarthi, 7th edition, Dhanpat Rai & Co. 2015.

2. "Introductory circuit analysis" by Robert L Boylestad, 12th edition, Pearson Education, 2013.

3. "Network analysis & synthesis" by Ravish. R. Singh, 1st edition, Mc-Graw Hill Education, 2016.

ELECTRICAL POWER GENERATION

Subject Code: UGEE1T0322	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

Course Objective: The aim of this course is to allow the students to understand the concepts of the conventional and Renewable energy resources.

Syllabus:

UNIT –I : (8 Hours)

Conventional Energy sources

Coal fired steam thermal power plant– layout, working principle- Gas turbine power plant– layout, working principle - Nuclear power plants: Operating principle, type of nuclear reactors.

UNIT –II: (8 Hours)

Solar PV System

Solar Photovoltaic Systems – Operating principle, VI and PV characteristics of solar PV array, Grid connected and stand- alone PV systems.

UNIT –III: (8 Hours)

Wind Energy Systems

Types of wind turbines – Kinetic energy of wind – Betz coefficient – Tip–speed ratio – Efficiency – Power output of wind turbine.

UNIT – IV: (10 Hours)

Hydro and Tidal power systems

Basic working principle of small and micro hydro turbines – measurement of head and flow – Energy equation-Tidal power – Basics –energy equation.

UNIT –V: (8 Hours)

Biomass, fuel cells and Geothermal systems

Biomass Energy: Fuel classification – Pyrolysis – Direct combustion of heat – Different digesters and sizing. Fuel cell: Classification – Efficiency – VI characteristics, Geothermal: Classification – Dry rock and acquifer-Energy analysis

Course Outcomes:

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

CO1: Explain principle of different types of conventional power generation (L2)

CO2: Explain principle of Solar PV Energy system (L2)

CO3: Classify different type of wind turbines and explain its operation (L2)

CO4: Explain basic principles and working of hydro, and Tidal energy systems(L2)

CO5: Interpret basic principle of biomass, fuel cell and Geothermal systems(L2)

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Electrical Power Systems by C. L. Wadhawa New Age International (P) Limited, Publishers, 1997.

2. Modern Power System Analysis by I. J. Nagarath and D. P. Kothari, Tata McGraw Hill, 2nd Edition.

REFERENCE BOOKS:

1."Renewable Energy"- Edited by Godfrey Boyle-oxford university Press, 3rd edition, 2013.

2. "Handbook of renewable technology" Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore.

3. "Renewable Energy Technologies "/Ramesh & Kumar /Narosa.

4. "Renewable energy technologies – A practical guide for beginners" – Chetong Singh Solanki, PHI.

PROBLEM SOLVING WITH 'C'
(Common to All Branches)

Subject Code: UGCS1T0222	**L**	**T**	**P**	**C**
I Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge on Mathematics and problem solving skills.

Course Objectives: The students will learn the basic knowledge of Computer components and program development steps. Students will be able to develop logic which will help them to create applications in C. Also by learning the basic programming constructs, they can easily switch over to any other language in future.

Syllabus

UNIT I: (10 hrs)

Introduction: Computer Systems, Programming Languages: Machine, Symbolic and High-level languages. Algorithm, Pseudo code, Flowchart.

Basics of C: History of C, Structure of a C program, Program development steps, C tokens, Keywords and Identifiers, Constants, Variables, Data Types, Managing Input and Output operations, Operators and expressions, Operator precedence and associativity, Type conversion.

UNIT II: (8 hrs)

Selection and Decision making: Decision making with If, simple if, If-else, Nesting of if else, else-if ladder, switch-statement, ternary Operator.

Iteration: Decision making and looping, while, do-while, for, jumps in loops.

UNIT III: (8 hrs)

Arrays: One-Dimensional Arrays, declaration of One-Dimensional Arrays, Initialization of One-Dimensional Arrays, Two-Dimensional Arrays, Initialization of Two-Dimensional Arrays, Multidimensional Arrays, Searching - Linear Search and Sorting - Bubble sort.

Strings: Declaring and Initializing String variables, Reading and writing Strings, String handling Functions, Table of Strings.

UNIT IV: (10 hrs)

Pointers: Understanding Pointers, accessing address of a variable, Declaring and Initialization of Pointer Variables, Pointer expressions, Pointer and Arrays, Dynamic Memory Allocation.

Functions: Need for user defined functions, Elements of User Defined Functions, Definition of Functions, Function Declaration and calling, Category of functions,

parameter-passing mechanism, passing an Array to a Function, scope, visibility and life time of variables, Pre-processor commands.

Recursion: Types of recursion, Recursive solutions for factorial, Fibonacci series, GCD.

UNIT V: (10 hrs)

Structures: Defining a Structure, Declaring and initialization of Structure variables, Accessing Structure members, Arrays of Structures, Pointers to Structures, Unions, Type Definition (typedef).

Files: Types of Files, Defining and opening a file, Input/output operations on files, Command-line Arguments.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Apply knowledge of C constructs for developing programs/applications.[L3]
CO2: Analyse the given C program to identify bugs and to write correct code.[L4]
CO3: Apply the concepts of Pointers, Dynamic memory allocation to write memory efficient programs.[L3]
CO4: Design C programs/applications for a given requirement.[L4]

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. E. Balagurusamy, C Programming, McGrawHill Publications.
2. Yashawant Kanitkar, Let us C, BPB publications

REFERENCE BOOKS:

1. Dennis Ritchie and Brian Kernighan, The C programming Language, Prentice Hall.
2. Herbert Schildt, C: The Complete Reference,4th Edition, Osborne Mc Graw Hill.
3. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach using C, 3rd Edition, Thomson Publications.
4. Reema Thareja, Programming in C, OXFORD.

COMPUTER AIDED ENGINEERING DRAWING LAB

Subject Code: UGME1P0322	**L**	**T**	**P**	**C**
I Year / I Semester	**0**	**0**	**3**	**1.5**

Course Objectives:

- To introduce the fundamentals of drafting to the students.
- To demonstrate the ability to draw, read, and interpret machine part/assembly/engineering drawing, using computer aided drafting.
- To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.

LIST OF EXERCISES

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of 2D wire frame modeling.
3. Draw the projections of points.
4. Draw the projections of straight lines.
5. Draw the projections of planes.
6. Drawing of front view and top view of simple solids like Prism, Pyramid, Cylinder, Cone, etc.
7. Drawing Isometric View of simple objects.
8. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.
9. Drawing of Isometric projections, orthographic projections of isometric projections, Modeling of Machines & Machine Parts (1^{st} Angle Orthogonal Projection Views).
10. Drawing of Isometric projections, orthographic projections of isometric projections, Modeling of Machines & Machine Parts (3^{rd} Angle Orthogonal Projection Views).

11. Drawing of front view, top view and side view of objects from the given pictorial views (eg. V-block, Simple stool, Objects with hole and curves).

12. Drawing of Typical Features in Isometric Pictorial drawings – Fillets, Rounded Edges, Threads, and Sectioning.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

COURSE OUTCOMES:

After completion of the course, the students would be able to:

CO1: Familiarize how industry communicates, practices for accuracy in presenting the technical information through drawing.(L2)

CO2: Develop the engineering perspective essential for representing orthographic projections.(L3)

CO3: Comprehend the theory of projection.(l3)

CO4: Apply the fundamentals of drafting with the aid of CAD package.(L3)

CO5: Familiar with Auto Cad two and three dimensional drawings.(L2)

CO6: Develop the engineering perspective essential for representing orthographic / isometric projections.(L3)

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	2	-	3	-	-	-	-	-	3	-	3	2
CO2	3	2	2	-	3	-	-	-	-	-	3	-	3	2
CO3	3	2	2	-	3	-	-	-	-	-	2	-	2	-
CO4	3	2	2	-	3	-	-	-	-	-	3	3	3	3
CO5	3	2	2	-	3	-	-	-	-	-	3	3	3	3
CO6	3	3	3	-	3	-	-	-	-	3	-	2	2	2

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications.
2. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers.
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age international Publishers.

REFERENCE BOOKS:

1. Engineering Graphics for Degree by K.C. John, PHI Publishers.
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers.
3. Engineering Graphics by PI Varghese, McGrawHill Publishers.

ENGINEERING CHEMISTRY LAB

Subject Code: UGBS1P0822	**L**	**T**	**P**	**C**
I Year / I Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Basic knowledge on Chemistry.

Course Objectives:

- To provide the students with a solid foundation in Chemistry laboratory required to solve engineering problems.
- To understand the principles of engineering chemistry associated with basics of Engineering.

List of Experiments:

1. Determination of suitable binding pose of drug and receptor by mcule online free software (Molecular Modeling-1).

2. Determination of suitable binding pose of drug and receptor by mcule online free software (Molecular Modeling-2).

3. Construction of Electrochemical cell.

4. Identification of unknown amino acids using thin layer chromatography.

5. Preparation of Bio-degradable polymer.

6. Determination of concentration of an unknown solution using conductance.

7. Potentiometric determination of strong acid vs strong base.

8. Determination of Ferrous ion by colorimetric method.

9. Determination of pH content in soft drinks and write a program based on the result and student should compare with standard values.

10. Estimation of vitamin-C in the given solution.

Course Outcomes:

Upon completion of the course, students will be able to:

CO1: Illustrate the computational chemistry to design a drug/molecule. (L2)
CO2: Illustrate the basic knowledge on volumetric and electrochemical analysis. (L3)
CO3: Interpret cell constant and reduction potentials of electrolytes. (L3)
CO4: Evaluate the Physical and chemical properties of solutions used in Engineering. (L5)

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	-		-	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	3	-	-	-	-	3
CO3	3	-	-	3	-	-	3	-	-	-	-	-
CO4	-	-	3	-	-	3	-	-	-	-	-	-

TEXT BOOK:

Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems by David Young (Author), Wiley publications.

PROBLEM SOLVING WITH 'C' LAB
(Common to All Branches)

Subject Code: UGCS1P0322	**L**	**T**	**P**	**C**
I Year / I Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Basic knowledge on Mathematics and problem solving skills.

Course Objectives:

1. The students will learn to develop the programs for solving the basic problems using operators, control statements and loops.
2. The Students will be able to write programs using concepts like Arrays, Strings, Pointers and Functions.

List of Experiments:

EXP 1:

a. Write a C program that will output your name and address using a separate printf() statement for each line of output.
b. Modify your solution for the previous program so that it produces all the output using only one printf() statement.
c. Write a C program to output the following text exactly as it appears here:
"C Programming……" she said.
d. Write a C program that prompts the user to enter a distance in inches and then outputs that distance in yards and feet.
e. Write a C program to convert the temperature from degree centigrade to Fahrenheit and vice versa.

EXP 2:

a. Write a C program to find the largest of three numbers using nested if-else.
b. Write a C Program to swap two numbers without using a temporary variable.
c. Write a simple program based on operators (pre, post increment, bitwise and, or, etc.).
d. Write a simple program based on type conversions (from int to float & float to int)

EXP 3:

a. Write a C program that displays all the numbers from X to Y, that are divisible by a and b. (X, Y, a and b should be read from the keyboard)
b. Write a C program that reads an unspecified number of integers, determines how many positive and negative values have been read, and computes the total and average of the input values, not counting zeros. Your program ends with the input 0. Display the average as a floating-point number. (For example, if you entered 1, 2, and 0, the average should be 1.5.)
c. Write a C program for finding student Grade by reading marks as input.

EXP 4:

a. The total distance travelled by vehicle in 't' seconds is given by distance s = $ut+1/2at^2$ where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec^2). Write a C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.
b. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
c. Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number.

EXP 5:

a. Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number.
b. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1, Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first 'n' terms of the sequence.
c. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

EXP 6:

a. Write a C Program to check whether the given number is Armstrong number or not.
b. Write C programs for the following series:

$$1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}$$

$$\frac{1}{3} + \frac{3}{5} + \frac{5}{7} + \frac{7}{9} + \frac{9}{11} + \frac{11}{13} + \cdots + \frac{95}{97} + \frac{97}{99}$$

c. Write a C program to find the roots of a Quadratic equation.
d. Write a C program to construct the following pyramid of numbers.

1 1 2 1 2 3	* * * * * *	1 2 3 4 5 6	A B B C C C D D D D E E E E E

EXP 7:

a. Write a C program to find the minimum and maximum integer of an Array.
b. Write a C program that uses functions to perform the following:
    i. Addition of Two Matrices
    ii. Multiplication of Two Matrices

EXP 8:

a. Write a C program to implement Linear Search.
b. Write a C program to implement sorting of an array using bubble sort.

EXP 9:

a. Write a C program to find length of the given string without using strlen().
b. Write a C program that uses functions to perform the following operations:
    i. To insert a sub-string into a given main string from a given position.
    ii. To delete n Characters from a given position in a given string.
c. Write a C program to determine if the given string is a palindrome or not

EXP 10:

a. Write a C program to swap two numbers using call by reference method.
b. Write a C program that uses a pointer to read and display Array elements.
c. Write a C program to create an array with calloc(), store the values into it and find their sum.

EXP 11:

a. Write C programs that use both recursive and non-recursive functions
    i. To find the factorial of a given integer.
    ii. To find the GCD (greatest common divisor) of two given integers.
b. Write C programs for implementing Storage classes: (Auto, register, static, extern)

EXP 12:

Examples that explore the use of structures and union.

EXP 13:

Handling file operations.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1 Apply various skills in problem solving. [L3]
CO 2 Analyze a given problem and develop an algorithm to solve it. [L4]
CO 3 Implement different operations on arrays, functions, pointers, structures, unions and files. [L4]

Mapping of COs to POs :

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Byron Gottfried, Jitender Chhabra, Programming with C (Schaum's Outlines Series), McGraw Hill Publishers.
2. Yashawanth Kanethkar, Let us C, 8th Edition, Jones & Bartlett Publishers, India.

REFERENCE BOOKS:

1. Herbert Schildt, C: The Complete Reference, 4th Edition, Mc Graw Hill.
2. B. A. Fouruzan and R. F. Gilberg, Computer Science: A Structured Programming Approach using C, 3rd Edition, Thomson Publications, New Delhi.
3. Dennis Ritchie and Brian Kernighan, The C programming Language, Prentice Hall.

I YEAR
II SEMESTER

MATHEMATICS-II

Subject Code: UGBS2T0122	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of Differentiation and Integration.

Course Objectives:

- To assist the students in learning Fourier series expansions of various periodic functions and the corresponding Fourier Transform
- To train the students to deal with multiple integrals and improper integrals
- To prepare the students to learn the concepts of Vector calculus

Syllabus:

UNIT-I: **(10 Hours)**

FOURIER SERIES

Introduction, Determination of Fourier coefficients, Even and Odd functions, Change of Interval, Half range Sine and Cosine series.

UNIT-II:

FOURIER TRANSFORMS **(10 Hours)**

Fourier Integral Theorem (Without proof) Fourier Sine and Cosine Integrals, Sine and Cosine Transforms, Properties, Inverse Transforms.

UNIT-III:

MULTIPLE INTEGRALS **(12 Hours)**

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form). Change of variables (Cartesian to polar) for double integrals.

Evaluation of Triple Integrals: Change of variables for triple integrals, (spherical polar coordinates, cylindrical coordinates)

UNIT-IV:

VECTOR DIFFERENTIATION **(10 Hours)**

Vector point functions and scalar point functions. Gradient, Divergence and Curl, Directional derivative, Solenoidal and Irrotational Vectors. Vector identities (without proof).

Application: Scalar potential function

UNIT-V:

VECTOR INTEGRATION (10 Hours)

Line, Surface and Volume Integrals. Green's, Gauss and Stoke's Theorems (without proofs) and their applications involving cubes, sphere and rectangular parallelepipeds.

Application: Work done by force as a line integral

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Find Fourier series expansion of various periodic functions (L2)

CO2: Represent a continuous function in Fourier integral form and hence find its Fourier Transform (L3)

CO3: Evaluate double and triple integrals in Cartesian and Polar coordinates over given regions (L3).

CO4: Determine the Gradient, Divergence and Curl of a vector field using vector differentiation (L4)

CO5: Evaluate vector integrals (Line, surface, volume) and justify the relation between them by integral theorems (L3)

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.

2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

REFERENCE BOOKS:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.

3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

5. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, 2002.

6. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2013.

APPLIED PHYSICS

Subject Code: UGBS2T0222	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Ray optics, Basics of Mechanics, Properties of Matter.

Course Objectives:

1. Impart the knowledge of optical phenomena like interference and diffraction required to design optical instruments with higher resolution.
2. Understand the physics of semiconductors and their working mechanisms to use in electronic circuits and devices.
3. Impart knowledge of materials with characteristics utility in appliances.

Syllabus

UNIT I: (10 Hours)

INTERFERENCE & DIFFRACTION:

Interference: Superposition principle, Young's double slit experiment and intensity curve, Conditions for good Interference - Interference in thin films (reflected geometry) – Newton's rings(reflected geometry) – Determination of Wavelength, Refractive index by Newton's rings.

Diffraction: Kinds of Diffraction – Fraunhoffer Diffraction at Single slit - Diffraction Grating – Intensity curves - Grating spectrum – Rayleigh's criterion and resolving power.

UNIT II: (10 Hours)

LASER & FIBRE OPTICS:

Laser: Characteristics – Spontaneous and Stimulated emission - Relation between Einstein's coefficients – Population inversion - Pumping Methods – Optical Resonator - Ruby laser - Helium-Neon laser – Applications of laser.

Fibre Optics: Construction and working of optical fibre - Acceptance angle & Numerical aperture – Types of fibres – Optical fibre communication system - Applications.

UNIT III: (10 Hours)

QUANTUM MECHANICS & FREE ELECTRON THEORY:

Quantum Mechanics: Introduction - Matter waves – Properties of Matter waves – Physical significance of wave function – Schrödinger Time Independent and Time Dependent wave equations – Particle in one dimensional infinite potential well.

Free electron & Band theory of Solids: Merits and Demerits of Classical free electron theory- Electrical conductivity based on Quantum Free electron theory –

Fermi - Dirac distribution function and Temperature dependence - Kronig-Penney model (qualitative) and results – Classification of crystalline solid.

UNIT IV: (10 Hours)

SEMICONDUCTOR PHYSICS:

Semiconductor: Introduction – Bond and Band structures of Intrinsic and Extrinsic semiconductors - Density of charge carriers in Intrinsic and Extrinsic - Fermi level (Temperature dependence)– Hall effect - Hall voltage – Hall Coefficient - Applications - Drift and Diffusion currents – p-n junction diode –Zener diode.

UNIT V: (10 Hours)

MAGNETIC & DIELECTRIC PROPERTIES:

Magnetism: Magnetic dipole moment– Permeability, Magnetization, Susceptibility - – Origin of permanent magnetic moment – Classification and Properties of Dia, Para & Ferro – Hysteresis – Soft and Hard magnetic materials and their applications.

Dielectrics: Dielectric constant, polarization, Polarizability, Susceptibility - Types of polarizations: Electronic and Ionic (Quantitative), Orientational polarizations (qualitative) – Lorentz Internal field – Claussius-Mossotti relation - Applications of dielectrics.

Course Outcomes:

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

CO1: Understand the phenomena of interference and diffraction with applications.
CO2: Interpret the knowledge of Laser and Optical fibre for engineering applications
CO3: Apply Schrodinger wave equation to estimate the behavior of particle.
CO4: Illustrate various free electron theories to classify solids.
CO5: Analyze the properties of semiconductors to construct basic electronic devices.
CO6: Summarize various magnetic and dielectric properties to know the scientific and engineering applications.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	-	-	2	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G. Kshirsagar - S. Chand Publications (2017)
2. "Engineering Physics" by D. Bhattacharya and PoonamTandon, Oxford press (2015)
3. "Engineering Physics" by R.K Gaur and S.L Gupta., - DhanpatRai publishers (2012)

REFERENCE BOOKS:

1. "Engineering Physics" by M. R. Srinivasan, New Age international publishers (2009)
2. "Optics" by AjoyGhatak, 6th Edition McGraw Hill Education (2017)
3. "Solid State Physics" by A. J. Dekker, McMillan Publishers (2011)
4. "Physics Volume –II", 5th edition, ResnickHalliday, Krane, by Wiley India
5. "Engineering Physics" by Dr. Armugam, Anuradha agencies

ENGLISH

Subject Code: UGBS2T0522	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic competency in grammar and composition

Course Objectives:

- To develop English language skills in listening, speaking, reading and writing by having learners engaged in a range of communicative tasks.
- To expand the learner's use of grammatically correct and situationally and culturally appropriate language in speaking and writing for effective communication in a variety of interpersonal and academic situations.

Syllabus:

UNIT-I: **(9 Hours**)

STAY HUNGRY – STAY FOOLISH – STEVE JOBS

Grammar : Verb -Tense

Speaking : Describing oneself and others, objects, places, processes and narrating events and stories.

Writing : Read different genres of novels and stories and produce them briefly.

UNIT-II: **(9 Hours)**

GIVE US A ROLE MODEL – A P J ABDUL KALAM

Grammar : Subject – Verb Agreement

Speaking : Framing appropriate questions and giving answers

Exercises Reading : Don't Ask your children to strive by William Martin

UNIT-III: **(9 Hours)**

TSUNAMI RELIGION –ANJALI PRASHAR

Vocabulary : Articles & Selected Prefixes, Suffixes and root words

Speaking **:** Extemporaneous speech

UNIT-IV: **(9 Hours)**

THE SECRET OF WORK - SWAMY VIVEKANANDA

Grammar : Active and Passive Voice

UNIT-V: **(9 Hours)**

A REVIEW ON THE MOVIE 'THE MAN FROM THE EARTH'(2007 release)

Composition : Paragraph writing on general topics

Listening : Listening Comprehension

Course Outcomes:

Upon the completion of the course, the students will be able to:

CO1: Infer the life lessons or stories of great people/characters and apply wherever possible inlife as well as use tenses correctly. (L2)

CO2: Examine the concept of ‗knowledge society' as well as learn to apply verb forms correctly for better communication. (L3)

CO3: Practice the philosophy that ‗all are equal'and apply it in every walk of life as well as use articles correctly in communication.(L3)

CO4: Illustrate the philosophy of work as well as use active and passive voice appropriately. (L4)

CO5: Evaluate the essence of any movie through writing/online quiz as well as write paragraphs' coherently. (L2)

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	3
CO4	-	-	-	-	-	-	-	-	3	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

TEXT BOOKS:

1. Infotech English - JNTUK prescribed text book – Maruthi Publications
2. Ignited Minds – A P J Abdul Kalam
3. English for Enjoyment and Efficiency – Maruthi Publications
4. Life, Language and Culture – Explorations –1 & 2 Cengage publishers

REFERENCE BOOKS:

1. The Oxford Guide to Writing & Speaking – John Seely
2. The students' Companion – Wilfred D Best (New Edition) – Harper, Collins Publishers,2012
3. Col-Locate Your World, a store house of words & word-relations, their similarities &dissimilarities – Ajay Singh, Arihant Publications (I) Pvt. Ltd., Meerut
4. Situational Grammar – M I Dubrovin (Visalandra Publishers)
5. Wren & Martin English Grammar and Composition – N.D.V.Prasada Rao

INTERNET SOURCES:

1. https://news.stanford.edu/2005/06/14/jobs-061505/ (Steve Jobs' Speech)
2. https://www.imdb.com/title/tt0756683/ (The Man from the Earth)

PYTHON PROGRAMMING

Subject Code: UGCS2T0222	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge on C programming.

Course Objectives:

- To learn about Python programming language syntax, semantics, and the runtime environment.
- To be familiarized with universal computer programming concepts like data types, containers.
- To be familiarized with general computer programming concepts like conditional execution, loops & functions.
- To be familiarized with general coding techniques and object-oriented programming.

Syllabus:

UNIT I: (8 Hrs)

Basics of Python Programming: Features of Python, Comparison with C, Python Virtual Machine, comments, indentation, literals, variables and identifiers, data types, operators, Input and Output Statements, type conversion, command Line Arguments.

Decision Control Statements: selection/conditional branching statements, basic loop structures, nested loops, break, continue and pass statements, else statement used with loops.

UNIT II: (10 Hrs)

Functions: Declaration and definition, calling a function, returning values from function, pass by object reference, Formal and actual arguments, Local and Global variables, recursive functions, lambda functions, Higher Order Function.

Data Structures: Strings and its operations, Lists: accessing and updating values in list, basic list operations and list methods, nested and cloning lists, list comprehensions, looping in lists, Tuples, Sets, Dictionaries and their operations.

UNIT III: (12 Hrs)

Classes and Objects: Introduction to Object Oriented Programming, classes and objects, Class method and self argument, __init__() method, class variables and object variables, __del__() method, other special method, public and private data members, built-in class functions and attributes, garbage collection, class and static methods.

Inheritance: Introduction, inheriting classes, types of inheritance, overriding methods, abstract classes and interfaces.

UNIT IV: **(10 Hrs)**

Modules: What are Modules, Modules and Files, Namespaces, Importing Modules, Module Built-in Functions, Packages.

Error and Exception Handing: Types of Errors, Exceptions, Handling Exceptions, types of exceptions, except block.

UNIT V: **(10 Hrs)**

Files: Introduction, Types of files, Opening and Closing files, Reading and Writing Files, Deleting files and Directory Methods.

Regular Expression Operations: Meta character in regular expression and Regular Expression Methods, Application of Regular Expression.

Course Outcomes:

Upon completion of the course, the students will be able to:

- **CO 1** Understand the Python syntax, semantics, basic programming constructs to be used to write the programs.[L2]
- **CO 2** Utilize the methods of various data structures to manipulate the data. [L3]
- **CO 3** Apply the appropriate Object-Oriented Programming principle for a given scenario.[L3]
- **CO 4** Develop bug free applications by handling different types of exceptions. [L4]

Mapping of COs to POs:

POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Reema thareja, Python Programming using problem solving approach, Oxford University Press.

REFERENCE BOOKS:

1. Dietel and Dietel, Python How to Program.
2. Kenneth A. lambert, B.L. Juneja, Fundamentals of Python, Cengage Learning
3. Dr. R. Nageswara Rao, Core Python Programming , Dreamtech Press

ELECTRICAL MACHINES-I

Subject Code: UGEE2T0122	**L**	**T**	**P**	**C**
I Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Fundamental Laws in Electromagnetism, Basic Electrical Engineering

Course Objective: To understand the concepts of Magnetic circuits, DC Machines and Transformers.

UNIT I: **(10 Hours)**

DC Generators

Construction features of DC machine, D.C. Generators – Principle of operation – E.M.F Equation, Armature reaction – Cross magnetizing and De-magnetizing AT/pole – Commutation Process – methods of improving commutation, Classification – Losses and Efficiency.

UNIT II: **(10 Hours)**

DC Motors

D.C Motors – Principle of operation – Back E.M.F.- Torque equation, Classification – Losses and Efficiency. Speed control of DC shunt Motors: Armature voltage and field flux control methods, Speed control of series motor.

UNIT III: **(10 Hours)**

Performance and Testing of D.C. Machines

Open circuit characteristic of separately excited DC generator, voltage build-up, critical field resistance and critical speed, Load characteristics of DC generators, Performance characteristics of DC Motors.

Direct Testing - Brake test on DC Motors, Load test on DC Generators, Indirect testing: Swinburne‘s test – Hopkinson‘s test – Field’s test - problems.

UNIT IV: **(10 Hours)**

Single-Phase Transformer and Auto Transformer

Constructional details, Operation of single-phase transformers at different loads with phasor diagrams – Equivalent Circuit, Testing - open circuit and short circuit tests, Efficiency and Regulation. Autotransformers – construction and principle.

UNIT V: **(8 Hours)**

Poly-Phase Transformer

Three-phase transformer - construction, types of connection and their comparative features, Phase conversion – Scott connection, Tap-changing transformers - No-load and ON-load tap changing of transformers, Three-winding transformers – Determination of Zp, Zs and Zt.

Course Outcomes: At the end of this course, students will be able to

CO1: Describe the constructional details and the concepts of DC Generators (L2)

CO2: Understand the concepts of DC Motors and apply speed control techniques.(L2)

CO3: Estimate the performance of DC Machines.(L3)

CO4: Distinguish and compare the constructional features of single phase, three phase Transformers and Auto Transformers and analyse their performance. (L2)

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	2	-	-	3	-	-	-	-	-
CO2	3	3	-	-	-	2	2	-	3	-	-	-	3	-
CO3	3	3	-	-	-	2	-	-	3	-	-	-	-	-
CO4	3	3	3	-	-	2	2	-	-	-	-	2	3	-

TEXT BOOKS:

1. "Electric Machinery", A. E. Fitzgerald, C. Kingsley and S. D. Umans, 6th Edition, McGraw-Hill, 2003.

2. "Performance and Design of Direct Current machines", A. E. Clayton and N. N. Hancock, 1st Edition, CBS Publishers, 2004.

3. "Electric Machines", I. J. Nagrath and D. P. Kothari, 5th Edition, McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. "A Text Book of Electrical Machines", R. K. Rajput, 4th Edition, Laxmi Publications, 2006.

2. "Electrical Machinery", P. S. Bimbhra, 7th Edition, Khanna Publishers, 2011.

3. "Electrical Machines", Smarajit Ghosh, 2nd Edition, Pearson, 2012.

PYTHON PROGRAMMING LAB

Subject Code: UGCS2P0422	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Basic understanding of Computer Programming terminologies.

Course Objectives:

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python.

Experiments:

1. Write a program to demonstrate different representations of numbers in Python.
2. Write a program to perform different complex Arithmetic Operations on numbers in Python.
3. Develop programs to demonstrate decision making and looping structures in python.
4. Write a program to demonstrate working with lists in python.
5. Write a program to demonstrate working with tuples in python.
6. Write a program to demonstrate working with dictionaries in python.
7. Write a program to create a module by adding a method and import the module in the application.
8. Write a program to create user defined exception and handle the exception in the application.
9. Write a program to demonstrate how to create classes and objects in the application.
10. Write the programs to demonstrate the files operations in python.
11. Demonstrate the regular expression for different scenarios.

Case Studies:

1. Case study on Loops:

   A perfect number is a number for which the sum of its proper divisors is exactly equal to the number. For example, the sum of the proper divisors of 28 would be 1 + 2 + 4 + 7 + 14 = 28, which means that 28 is a perfect number. A number *n* is called deficient if the sum of its proper divisors is less than *n* and it is called abundant if this sum exceeds *n*. Write a program for the given large n, find the sum of all perfect numbers, sum of all deficient numbers and sum of abundant numbers separately. Print all perfect numbers along with its sum, deficient numbers along with its sum and abundant numbers along with its sum.

2. Case studies on Functions:
   a) Write a function "remove_duplicates" which takes a string argument and returns a string which is the same as the argument except only the first occurrence of each letter is present. Make your function case sensitive.

b) Write a function mult_lists(a, b) that takes two lists of numbers of the same length, and returns the sum of the products of the corresponding elements of each.

c) Write a function called flatten_list that takes as input a list which may be nested, and returns a non-nested list with all the elements of the input list.

3. Case study on modules:

Create a module "Prime" to include the following functions.

a) isPrime(number) : returns Boolean whether the given number is prime number or not.

b) isPalindromePrime(number) : returns Boolean whether the given number is prime with palindromic. Example 131 is a palindromic prime.

c) isEmirp(number) : returns Boolean whether the given number and its reversal number are also prime numbers. Example 17 and 71 are both Emirps.

d) mersennePrime(p): returns $\mathbf{2^p - 1}$ value for given integer p if it is prime number.

e) printTwinPrimes(range) : prints all twin prime numbers below given range.

Write a test program to import the Prime module and perform the following operations using the functions of Prime module.

- Prints first 100 prime numbers.
- Prints first 100 Palindrome prime numbers.
- Prints first 100 Emirp numbers.
- Prints all Mersenne prime numbers for the p value below 32.
- Prints all twin prime numbers below 1000.

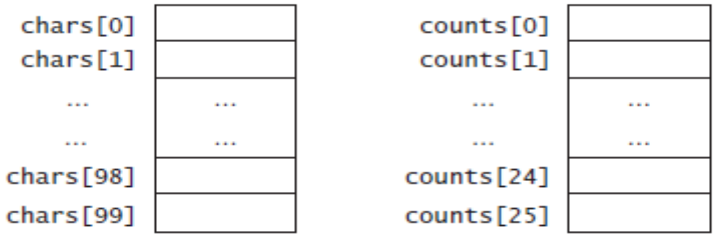
4. Case study on Lists:

Counting the occurrence of each letter.

The program counts the occurrence of each letter among 100 letters.

Procedure

- Generates 100 lowercase letters randomly and assigns them to a list of characters, named **chars**. You can obtain a random letter by using the **getRandomLowerCaseLetter()** function in the **RandomCharacter** module. (Import RandomCharacter module into your program)
- Counts the occurrences of each letter in the list. To do so, it creates a list named **counts** that has 26 **int** values, each of which counts the occurrences of a letter. That is, **counts[0]** counts the number of times **a** appears in the list, **counts[1]** counts the number of time **b** appears, and so on.



5. Case study on Classes:
   Design a class named QuadraticEquation for a quadratic equation $ax^2+bx+c=0$. The class contains:
   - The private data fields a, b, c that represents three coefficients.
   - A constructor for the arguments for a, b and c
   - Three get methods for a, b and c
   - A method named getDiscriminant() that returns the discriminant, which is b^2-4ac.
   - The methods named getRoot1() and getRoot2() for returning the two roots of the equation using the formulas:
     $R1 = -b + (\sqrt{b^2-4ac})/2a$ and $R2 = -b - (\sqrt{b^2-4ac})/2a$.
   - These methods are useful only if the discriminant is non negative. Let these methods return 0 if the discriminant is negative.
   - Write a test program that prompts the user to enter values for a, b, c and displays the result based on discriminant.

Course Outcomes:

Upon completion of the course, the students will be able to:

- **CO 1.** Understand python programming structure for solving basic programming problems.[L2]
- **CO 2.** Use primitive data types, selection statements, loops, function, and classes to write programs. [L3]
- **CO 3.** Develop programs for a given scenario. [L3]
- **CO 4.** Analyze different data structures and choose suitable one for a given problem. [L4]

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. Reema thareja, Python Programming using problem solving approach, Oxford University Press, 1st Edition.
2. Kenneth a. lambert, B.L. Juneja, Fundamentals of Python, Cengage Learning, 1st Edition.
3. Chun, J Wesley, Core Python Programming, 2nd Edition, Pearson.

REFERENCE BOOKS:

1. Dietel and Dietel, Python How to Program, 1st Edition.
2. Barry, Paul, Head First Python, 2nd Edition, O Rielly.
3. Lutz, Mark, Learning Python, 4th Edition, O Rielly.

APPLIED PHYSICS LAB

Subject Code: UGBS2P0622	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Knowledge on measuring instruments, electricity and magnetism.

Course Objectives:

1. Gain knowledge in various areas of physics to apply real time applications
2. Use fundamental techniques and skills of physics in modern engineering
3. Enhance analytical thinking and to improve problem solving techniques

Syllabus:

(Any 8 of the following listed 15 experiments can be done)

Experiment 1:
Determination of thickness of a spacer using wedge film and parallel interference fringes

Experiment 2:
Newton's rings – Radius of Curvature of Plano - Convex Lens

Experiment 3:
Determination of wavelength of a source-Diffraction Grating-Normal incidence

Experiment 4:
Determination of width of a slit using Laser diffraction

Experiment 5:
Determination of numerical aperture of a given optical fibre

Experiment 6:
Determination of Planck's constant using photo cell

Experiment 7:
Study the V-I characteristics of p-n junction diode

Experiment 8:
Study the V-I characteristics of Zener diode

Experiment 9:
Study the current characteristics of PIN diode

Experiment 10:
Energy Band gap of a Semiconductor p-n junction

Experiment 11:
Characteristics of Thermistor – Temperature Coefficients

Experiment 12:
Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall effect

Experiment 13:
Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus

Experiment 14:
Study the variation of Magnetic induction (B) versus Magnetic field strength (H) by magnetizing the magnetic material (B-H curve)

Experiment 15:
Determination of dielectric constant by charging and discharging method.

Course Outcomes:
At the end of this course, students will be able to
CO1: Apply the scientific knowledge to understand optical concepts.
CO2: Experiment with basic electronic circuits to understand their function.
CO3: Study the magnetic behaviour of materials.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-

TEXT BOOKS:
1. "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G. Kshirsagar - S. Chand Publications (2017)
2. "Engineering Physics" by R.K Gaur and S.L Gupta., - DhanpatRai publishers (2012)

ENGLISH COMMUNICATION SKILLS LAB

Subject Code: UGBS2P0922	**L**	**T**	**P**	**C**
I Year / II Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Basic knowledge in using language for oral communication.

Course Objectives:

- To enable learners to use the correct pronunciation of English sounds.
- To prepare students to use different functions of English Language.

Syllabus:

Week1: Greeting, Introducing and Taking leave

Week2: Pure Vowels

Week3: Giving information and Asking for information

Week4: Diphthongs

Week5: Inviting, Accepting and Declining Invitations

Week6: Consonants

Week7: Commands, Instructions and Requests

Week8: Syllables

Week9: Suggestions and Opinions

Week10: Accent

Topics beyond syllabus:

A. JAM
B. BBC Flatmates

Course Outcomes:

Upon the completion of the course, the students will be able to:

CO1: Articulate correct pronunciation of Pure Vowel‘ sounds for oral communication as well as enable them to greet and take leave of others appropriately. (L3)
CO2: Practice correct pronunciation of Diphthongs‘ for oral communication as well as give and ask information in real life situations. (L3)
CO3: Identify the correct use of consonants as well as how to invite, accept and decline Invitations in daily conversations. (L1)

CO4: Practice correct syllable division as well as make commands, instructions and requests in daily life. (L3)

CO5: Analyze correct accent as well as use correct expressions for suggestions and opinions while speaking. (L1)

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

TEXT BOOKS:

1. Strengthen Your Steps – Maruthi Publications (the latest edition)
2. Interact – English Lab Manual for Undergraduate Students – Orient BlackSwan

REFERENCE BOOKS:

1. English Conversation Practice – Grant Taylor, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2007.
2. A series of 'ROBIN READERS' published by Orient Black Swan

INTERNET SOURCES:

1. www.flatmates.com
2. https://learnenglish.britishcouncil.org/ (Learn English – British Council)

INDIAN CONSTITUTION

Subject Code: UGBS2A1022	**L**	**T**	**P**	**C**
I Year / II Semester	**2**	**0**	**0**	**0**

Prerequisites: Basic knowledge about fundamental rights and role of state and central governments.

Course Objectives:

- To understand fundamental rights and its implications.
- To enable an understanding of the nature and basic foundations of Indian constitution.
- To impart knowledge about the state and central policies, electoral process, amendments and provisions.

Syllabus:

UNIT-I: (5 Hours)

Introduction to Indian Constitution

Meaning of the term Indian Constitution – Preamble - Constituent Assembly - Salient Features of Indian Constitution.

UNIT-II: (5 hours)

Fundamental Rights

Fundamental Rights - Fundamental Duties - The Directive Principles of State Policy.

UNIT-III: (6 Hours)

Union Government

Union Legislature (Parliament) - Lok Sabha and Rajya Sabha (with Powers and Functions) - Union Executive - President of India (with Powers and Functions) - Prime Minister of India (with Powers and Functions) - Union Judiciary (Supreme Court) -Jurisdiction of the Supreme Court.

UNIT-IV: (6 Hours)

State Government

State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) - Powers and Functions of the State Legislature - State Executive - Governor of the State (with Powers and Functions) - The Chief Minister of the State (with Powers and Functions) - State Judiciary (High Courts).

UNIT-V: (6 Hours)

Local Self Governance

Powers and functions of Municipalities, Panchayats, ZPs and Co-operative Societies.

Sovereign Bodies
Election Commission of India (with Powers and Functions) - The Union Public Service Commission (with Powers and Functions).

Course Outcomes:
Upon completion of the course, the students will be able to:
CO1: Simplify the emergence and evolution of Indian Constitution. (L4)
CO2: Summarize the structure and composition of Indian Constitution. (L2)
CO3: Illustrate and analyze the three organs of the state in the contemporary scenario.(L2)
CO4: Examine the fundamental rights and duties of Indian citizens with a study of the significance and status of directive principles. (L4)
CO5: Explain the concept of sovereignty and understand the electoral process and its provisions.(L2)
CO6: Infer and assess the important institutions of the Indian union.(L2)
CO7: Analyze the successful functioning of Democracy in India (L4)

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	3	3	-	-	-	-	-
CO2	-	-	-	-	-	3	3	-	-	-	-	3
CO3	-	-	-	-	-	3	3	3	-	-	-	3
CO4	-	-	-	-	-	3	3	-	-	-	-	-
CO5	-	-	-	-	-	3	-	3	-	-	-	3
CO6	-	-	-	-	-	-	-	3	-	-	-	3
CO7	-	-	-	-	-	-	-	3	-	-	-	3

TEXT BOOKS:
1. Introduction to Constitution of India, Durga Das Basu, Lexis Nexis Publications
2. Constitution of India by Professional Book Publications
3. The Constitution of India by Arun K Tiru Vengadam, Blooms Bury Publishers
4. The Constitution of India by PM Bakshi, Universal Law Publishing Co.
5. The Constitution of India by S R Bhansali, Universal Law Publishing Co.

II B.Tech.
I Semester

NUMERICAL METHODS AND COMPLEX VARIABLES

Subject Code: UGBS3T0522	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

- To make students understand the importance of approximate solutions essential in various complex problems.
- To understand basic principles of complex analytic functions.
- To solve engineering problems involving complex integrals

Syllabus:

Unit-I: Solution of algebraic and transcendental equations (10 Hours)
Introduction– Bisection method, Iteration method, Regula-Falsi method and Newton-Raphson method.

Unit-II: Interpolation (10 Hours)
Introduction- Finite differences- forward differences- backward differences- Interpolation using Newton's forward and backward difference formulae.Lagrange's interpolation formula for unevenly spaced points.

Unit-III: Solutions of Ordinary differential equations & Numerical Integration (10 Hours)
Taylor's series, Runge- Kutta method of fourth order for solving first order equations.

Trapezoidal rule and Simpson's 1/3rd and 3/8 rules for Numerical integration

Unit-IV: Functions of a complex variable & Complex integration (12Hours)
Introduction –– Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and Conjugate harmonic functions – Milne – Thompson method.
Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs)

Unit-V: Series expansions and Residue Theorem: (12 Hours)
Radius of convergence – Expansion of a function in Taylor's series, Maclaurin's series and Laurent series. Singularities and Residues: Classification of singularities, Poles and Zeros, Residues- Residue theorem(without proof)- evaluation of real integrals around the unit circle and semi circle

Course outcomes:

CO1: Obtain roots of a polynomial or transcendental equation using various numerical methods (L3)

CO2: Demonstrate various interpolation methods and finite difference concepts in real time data (L2)

CO3: Determine approximate solutions to Ordinary differential equations and integral of a function using different numerical methods (L5)

CO4: Illustrate the concepts of analytic functions, Cauchy-Riemann equations, harmonic, entire functions and apply the Cauchy integral theorem to compute complex integrals (L3)

CO5: Analyze functions of complex variables using series expansions and evaluate some types of real integrals (L4)

Mapping of COs to POs:

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

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.

REFERENCE BOOKS:

1. V.Ravindranath,P.VijayaLakshmi,A text book on Mathematical Methods,Himalaya Publishing House, Revised edition:2011.
2. Dr.T.K.V. Iyengar, Dr. B. Krishna Gandhi, S.Ranganatham, M.V.S.S.N.Prasad , Engineering Mathematics Volume III. Revised edition:2010.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002.
4. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2013.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. Shanti Narayan & P K Mittal, Theory of Functions of A Complex Variable, 1st edition, S. Chand Publishing, 2005.

ELECTRICAL CIRCUIT ANALYSIS-II

Subject Code: UGEE3T0122	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Laplace Transforms, Vectors, Complex numbers, Electrical circuits Analysis-I

Course Objective: This course aims at study of coupled circuits, three phase systems, transient analysis and two port networks for the future study and analysis of power systems.

Syllabus:

UNIT- I: Analysis of Coupled Circuits (8 Hours)

Basic definitions of Magnetic circuits, Faraday's laws of electromagnetic induction, Self, mutual Inductance, coupling coefficient, Self, Mutual Inductance and their relation, Dot Convention, Series, and parallel aiding and opposing.

UNIT –II: Balanced and Unbalanced Three phase circuits (9 Hours)

Phase sequence- star and delta connection - relation between line and phase voltages and currents - analysis of balanced three phase circuits –Unbalanced Three phase circuits- Three-phase power measurement.

UNIT –III: Time Domain Analysis of Electrical Circuits (9 Hours)

Time-domain analysis of first and second order differential equations for Series and parallel R-L, R-C, RLC circuits for DC and AC excitations, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

UNIT –IV: Electrical Circuit Analysis Using Laplace Transforms (8 Hours)

Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros, Frequency response (magnitude and phase plots).

UNIT –V: Two Port Networks (8 Hours)

Z parameters, Y parameters, ABCD parameters and hybrid parameters and their relations. Relationships between parameter sets simplification of cascaded and parallel networks

Course Outcomes: At the end of this course, students will be able to

CO1: Analyze coupled circuits under different connections

CO2: Analyze balanced and unbalanced three phase circuits and to determine three-phase power.

CO3: Extend the knowledge of mathematics to analyze transient and steady state response of electrical circuits in time domain and s-domain.

CO4: Deduce and relate two-port parameters for a given two-port network.

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3

TEXTBOOKS:

1. "Engineering Circuit Analysis" by William Hayt and Jack E. Kemmerley, 6th edition, McGraw Hill Company

2. "Network Analysis" by Van Valkenburg, 3rd edition, PHI Learning, 2006.

3. "Fundamentals of Electric circuits" by C. K. Alexander and M. N. O. Sadiku, 5th edition, Mc Graw hill Publishers, 2013.

REFERENCE BOOKS

1. "Circuit Theory (Analysis and Synthesis) by A. Chakrabarthi, 7th edition, Dhanpat Rai & co. 2015.

2. "Introductory circuit analysis" by Robert L Boylestad, 12th edition, Pearson Education, 2013.

3. "Network analysis & synthesis" by Ravish. R. Singh, 1st edition, Mc-Graw Hill Education, 2016.

ELECTRICAL MACHINES-II

Subject Code: UGEE3T0222	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Fundamental Laws in Electromagnetism, Electrical Machines-I

Course Objective: To understand the concepts of Induction and Synchronous Machines.

Syllabus:

UNIT I: Single-Phase Induction motors (8 Hours)
Single phase induction motors- Double revolving field theory, starting methods, Torque-speed characteristics, equivalent circuit - determination of parameters.

UNIT II: Three Phase Induction Machines (10 Hours)
Principle and operation, Types (squirrel cage and slip-ring), EMF equation, slip, rotor current, starting torque, running torque, maximum torque, Power stages, relationship between rotor input, rotor copper loss, and mechanical power developed, losses and efficiency.

UNIT III: Performance of Induction Motor (10 Hours)
Equivalent circuit, Phasor Diagram, Effect of parameter variation on torque-speed characteristics (variation of Rotor resistance, stator voltage, frequency)

No load and blocked rotor tests - Circle diagram – predetermination of performance. Methods of starting - DOL, Star-Delta & Auto-transformer, Rotor resistance starting

UNIT IV: Synchronous Generators (10 Hours)
Synchronous generator- construction, equivalent circuit and phasor diagram, voltage regulation methods by EMF & ZPF, Salient pole machine - Two Reaction Theory, phasor diagram, slip test-determination of Xd and Xq. Parallel operation of alternators - synchronization and load sharing, Power stages, losses and efficiency.

UNIT V: Synchronous Motors (8 Hours)
Principle of operation - methods of starting - phasor diagram, Power stages, losses and efficiency, V and inverted V curves, mathematical analysis for power developed – hunting and its suppression.

Course Outcomes: At the end of this course, students will be able to

CO1: Describe the construction, operation & equivalent circuit of Single Phase Induction Motor

CO2: Classify the three phase induction motors and analyse the power stages

CO3: Analyze the performance of three phase Induction Motor.

CO4: Examine synchronous machine model and analyze the performance of synchronous Machines.

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3		3		2			3					
CO2	3	3				2			3					
CO3	3	3	3			2			3			2		
CO4	3	3		3		2						2		

TEXT BOOKS:

1. "Electric Machinery", A. E. Fitzgerald, C. Kingsley and S. D. Umans, 6th Edition, McGraw-Hill, 2003.

2. "Performance and Design of Alternating Current Machines", M. G. Say, 3rd Edition, CBS Publishers, 2002.

3. "Electrical Machinery", P. S. Bimbhra, 7th Edition, Khanna Publishers, 2011.

REFERENCE BOOKS:

1. "Electric Machines", I. J. Nagrath and D. P. Kothari, 5th Edition, McGraw Hill Education, 2010.

2. "Theory of Alternating Current Machinery", A. S. Langsdorf, 2nd Edition Tata-McGraw-Hill Education, 1990.

3. "Principles of Electric Machines and Power Electronics", P. C. Sen, 3rd Edition, John Wiley & Sons, 2014.

DIGITAL LOGIC CIRCUITS

Subject Code: UGEE3T0322	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Course Objective:

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits
- To illustrate the concept of synchronous sequential circuits
- To introduce the concept of memories and programmable logic devices.

Syllabus:

UNIT –I: Digital Fundamentals (8 Hours)

Number Systems and Conversions – Decimal, Binary, Octal, Hexadecimal, 1's & 2's complements and its methods of subtraction, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Error detection and correction codes, parity checking, Hamming code.

Unit-II: Minimization Techniques (8 Hours)

Logic gates, Boolean theorems, Minimization of logic functions using Boolean theorems, Sum of products and Product of sums, Minterms and Maxterms, Karnaugh map (up to Four variables) and Quine-McCluskey method.

UNIT –III: Combinational Circuit Design (12 Hours)

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Decoder, Encoder, Priority Encoder, Magnitude Comparator

Programmable Logic Devices

Basic memory structure – ROM -PROM – EPROM, EEPROM, RAM – Static and dynamic RAM – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL

UNIT – IV: Sequential Circuits - I (8 Hours)

Latches, Flip flop, Triggering of Flip-flops, Flip-flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, conversion of FF to another FF.

UNIT –V: Sequential Circuits -II (8 Hours)

Circuit implementation – Counters: Design of Counters- Ripple Counters, Ring Counters, Jonson Counter.

Registers: Shift registers, Universal Shift Register, Bidirectional Shift register.

Analysis and design of clocked sequential circuits: Moore/Mealy models, state minimization, state assignment.

Course Outcomes: At the end of this course, students will be able to

CO1: Understand the fundamentals of Digital logic circuits

CO2: Analyze different methods used for simplification of Boolean expressions

CO3: Design and implement Combinational circuits

CO4: Apply the memory devices in different types of digital circuits

CO5: Develop skill to design sequential circuits

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													
CO2	3	3	3											
CO3	3	3	3											
CO4	3	3	3											
CO5	3	2	2											

TEXT BOOKS:

1. Raj Kamal, 'Digital Systems-Principles and Design', Pearson education 2nd edition, 2007
2. M. Morris Mano, 'Digital Design', Pearson Education, 2006.
3. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.
4. Digital Electronics and Logic Design, Dr. Sanjay Sarma, Katson Books, Fourth Edition, 2016.

REFERENCE BOOKS:

1. Charles H.Roth, 'Fundamentals Logic Design', Jaico Publishing, IV edition, 2002.
2. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
3. John F.Wakerly, 'Digital Design Principles and Practice', 3rd edition, Pearson Education, 2002.
4. Tocci, "Digital Systems: Principles and applications, 8th Edition" Pearson Education.

ANALOG ELECTRONICS

Subject Code: UGEE3T0422	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Semiconductor Physics

Course Objective: The objective of this course is to introduce the students about the fundamental's concepts of semiconductor diodes, Transistor and their applications. It also introduces wave shaping concepts of both linear and non-linear circuits and design of multivibrators. At the end of the course, the students are expected to know about the applications of the semiconductor devices.

Syllabus:

UNIT –I: Junction Diode Characteristics **10 Hours**

P-N junction diode, diode current equation, I-V characteristics of a diode, Temp Dependence on V- I Characteristics, diode resistance and capacitance, Diode Equivalent Circuits(models), Zener diode and its characteristics, LED, LCD, Photo diode, Tunnel diode, Varacter Diode.

UNIT –II: Diode Applications **12 Hours**

Diode Clippers: Shunt Clippers, Series clippers, clipping at two independent levels, transfer characteristics of clippers, Design of clippers Diode Clampers: Positive clampers, negative clampers, Design of clampers

Rectifiers and Voltage regulator: Zener diode as a voltage regulator

UNIT–III: Transistor Characteristics, Biasing And Applications **12 Hours**

BJT: Structure and configuration of BJT with input and output characteristics, Operating point and load line analysis

MOSFET: Structure, Characteristics, Operating point and load line analysis

BJT Biasing: Need for Biasing, different methods. MOSFET biasing: different methods. Generalized analysis of transistor amplifier model using h-parameters (frequency response)

Applications: BJT as a switch, BJT as an amplifier (Single stage), MOSFET as a switch, MOSFET as an amplifier.

UNIT –IV: Linear Wave Shaping And Multivibrators **10 Hours**

LINEAR WAVE SHAPING: Response of High pass and low pass RC circuits to different signals (sinusoidal, step, pulse, square and ramp), high pass RC circuit as a differentiator, low pass RC circuit as an integrator.

UNIT –V: Power Semi-Conductor Devices **10 Hours**

Basic theory of operation and characteristics of power Diode, power MOSFET and power IGBT – Thyristor family description – Basic theory of operation of SCR – Static characteristics – Turn on and turn off methods -Firing circuits for SCR.

Course Outcomes: At the end of this course, students will be able to

CO1: Explain working, characteristics and properties of different types of semiconductor diodes and Transistors.

CO2: Analyze the biasing of transistor circuits and develop various applications using the diodes and transistors

CO3: Analyze and design various linear wave shaping circuits and multivibrator circuits

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	3

TEXT BOOKS:

1. "Electronic Devices and Circuits", J Millman, Chritophas C Halkias, and Satyabratajit Vol 1, 4th Edition, McGraw Hill Edition, 2015.
2. "Pulse, Digital and Switching Waveforms", Jacob Millman and Herbert Taub, Vol 1, 3rd Edition, McGraw Hill Edition, 2011.
3. "Electronic Devices and Circuit theory", R L Boylestad and Louis Nashelsky, Vol 1, 11th Edition, Pearson Education, 2006.
4. "Pulse and Digital Circuits", Venkata Rao K, Rama Sudha K and Manmadha Rao G, Vol 1, 1st Edition, 2010.

REFERENCE BOOKS:

1. "ELECTRONIC PRINCIPLES", Albert Malvino and David J Bates, Vol 1, 8th Edition, MC Graw Hill Edition, 2015
2. "Electronic Devices", Thomas L Floyd, Vol 1, 9th Edition, Pearson Education, 1996
3. "Electronic Devices and Circuits", David A Bell, Vol 1, 5th Edition, Oxford University Press, 2008.
4. "Electronic Devices &Circuits", J B Gupta, Vol 1, 6st Edition, S K Kataria & Sons, 2016

ELECTRICAL CIRCUTS LAB

Subject Code: UGEE3P0522	**L**	**T**	**P**	**C**
II Year / I Semester	**0**	**0**	**3**	**1.5**

List of Experiments

Any 10 of the following experiments are to be conducted

1. Verification of Thevenin's and Norton's Theorems.
2. Verification of Superposition theorem
3. Verification of Maximum Power Transfer Theorem.
4. Verification of Reciprocity Theorem
5. Verification of Millman's Theorem
6. Series Resonance
7. Parallel Resonance
8. Determination of Self, Mutual Inductances and Coefficient of coupling.
9. Z and Y Parameters
10. Transmission and hybrid parameters

Additional experiments

11. Finding node voltage and currents in a given circuit using nodal equations in MATLAB
12. Finding voltage and currents in a given circuit using mesh equations in MATLAB

Course Outcomes: At the end of this course, students will be able to

CO1: verify various network theorems

CO2: Determine the resonant Frequency, quality factor & bandwidth of the RLC circuits

CO3: Determine parameters of a given two-port network

CO4: Determine parameters of magnetic coupled circuits

CO5: interpret the response of series and parallel RLC circuits under resonance

Mapping of COs to POs:

POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

ELECTRICAL MACHINES- I LAB

Subject Code: UGEE3P0622	**L**	**T**	**P**	**C**
II Year / I Semester	**0**	**0**	**3**	**1.5**

List of Experiments

1. Magnetization characteristics of DC Shunt Generator. Determination of critical field resistance and critical speed.
2. Load test on DC Shunt Generator. Determination of Characteristics.
3. Load test on DC Series Generator. Determination of Characteristics.
4. Load test on DC compound Generator. Determination of Characteristics.
5. Hopkinson‘s test on DC shunt machines. Predetermination of efficiency.
6. Field‘s test on DC series machines. Determination of efficiency.
7. Swinburne‘s Test. Predetermination of DC Generator and DC Motor Efficiency.
8. Brake Test on DC compound motor. Determination of performance curves.
9. Brake Test on DC shunt motor. Determination of Performance curves.
10. Separation of losses in a DC Shunt motor.
11. Speed Control of DC Shunt Motor by Field and Armature Control Methods.
12. Retardation Test on DC Shunt machine.

Course Outcomes: At the end of this course, students will be able to

CO1: Examine the performance characteristics of various DC Generators

CO2: Determine the efficiency and losses of DC machines by conducting suitable tests

CO3: Examine the performance curves of various DC Motors

CO4: Analyze the behaviour of dc shunt motor by separating losses and test for speed control

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1			3	3								2		
CO2			3	3								2		
CO3			3	3								2		
CO4			3	3								2		

ELECTRICAL & MECHANICAL LABORATORY

Subject Code: UGEE3P0722	L	T	P	C
II Year / I Semester	-	-	3	1.5

Course Objectives:

- To identify the process of electrical power distribution safely from delivery point to various electrical loads around a building
- The purpose of Mechanical laboratory is to reinforce and enhance understanding of the fundamentals of Fluid mechanics and Hydraulic machines.

List of Electrical Experiments:

Any five experiments to be done from the below list:

1. Series and parallel connection of bulbs
2. Stair case wiring
3. Florescent Lamp
4. Residential house wiring
5. GoDown wiring
6. Measurement of Earth Resistance
7. Testing of Passive components
8. Testing of Electronic devices
9. Study and Operation of basic measuring devices

List of Mechanical Experiments:

Any five experiments to be done from the below list:

1. Calibration of Venturi meter and Orifice meter
2. Verification of Bernoulli's theorem.
3. Performance test on Pelton Wheel Turbine.
4. Performance test on Francis Turbine.
5. Performance test on Kaplan Turbine.
6. Performance test on Centrifugal Pump.
7. Performance test on Reciprocating Pump.

Course Outcomes:

Upon the completion of the course, the students will able to:

CO1: Experience the needs in House wiring while coordinating the various electrical components with protection and safety standards.

CO2: Test the performance of electronic devices

CO3: Determine and analyse the hydrodynamic forces acting on vanes.

CO4: Understand the elements of the hydroelectric power station

CO5: Evaluate the performance of Turbines and pumps under different working conditions.

Mapping of COs to POs:

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

REFERENCES:

1. College lab manual.
2. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
3. Fluid Mechanics and Hydraulic Machines by R K Bansal.

ARTS
(Common to all branches)

Subject Code: UGBS3C0122	**L**	**T**	**P**	**C**
II Year / I Semester	**1**	**0**	**2**	**2**

Course Objectives:

Arts is an integral part of the development of human beings since the arts are what make us most human, most complete as people. They offer us the experience of wholeness because they touch us at the deepest levels of mind and personality. Learning of arts promotes self-esteem, motivation, aesthetic awareness, cultural exposure, creativity, improved emotional expression, as well as social harmony and appreciation of diversity. They promote an understanding and sharing of culture, and equip the learners with social skills that enhance the awareness and respect of others.

A range of introductory courses are offered in different art forms: Creative Writing, Drawing & Painting, Presentation Movement (Dancing), Stitching Stories – Embroidery, Playback Singing, Organic Farming, Design Thinking, Desktop Music Production and Food Technology.

Students will be given an option to choose a particular art form, and learn and practice it under an instructor.

1. CREATIVE WRITING

Syllabus:

UNIT-I: Introduction to Creative Writing - Characteristics of Good Writing - Figurative Language. 8 hrs

UNIT-II: Picture Prompts for Script Writing (Characters – Plot – Dialogues) – Imagery. 8 hrs

UNIT-III: Personal Introduction Speech – Vocabulary – Humour - Make an Outline – Hobbies or Themes – Trimming. 8 hrs

UNIT-IV: Script for Film - Script for TV or Radio – Sensory Details- Point of View – Prompts. 8 hrs

UNIT-V: Fiction/Short story - Adventure Story- Character, Setting, Plot – Prompts. 8 hrs

REFERENCE BOOKS:

1. The Cambridge Companion to Creative Writing (South Asian Edition)
2. Creative Writing: A Beginner's Manual (Paper Back Edition)

USEFUL WEBSITES:

1. Script for Film, TV or Radio:
   https://www.bbc.co.uk/bitesize/guides/zy722hv/revision/7

2. DRAWING & PAINTING

Syllabus:

1. INTRODUCTION – Basic Elements of arts – 1 Hr.

2. DRAWING OBJECTS – Common objects (Pencil Ink), Still Life (Pencil Shading Flowers, Animals, and Birds), doodles using shapes – 5 Hrs.

3. LANDSCAPES – Perspective, Urban sketching – 5 Hrs.

4. HUMAN FIGURE - How to Draw, Introduction, Skeletons, Skeletons Development, Blocked Construction, Facial Expression, Movements of the Body, Daily Life. - 4 Hrs.

5. ACRYLIC PAINTING - Still life, landscape, knife painting - 18 Hrs.

6. BRUSH CALLIGRAHY - Basic strokes, letters, word formation, Bouncy letters, poster making using calligraphy - 5 Hrs.

Reference Books:

1) How to paint : Artist's Painting Techniques: Explore Watercolors, Acrylics, and Oils; Discover Your Own Style; Grow as an Art by Meachum Drey.

2) Painting & Drawing: Techniques and Tutorials for the Complete Beginner, by Kendra Ferreira, GMC Publications.

3. PRESENTATION MOVEMENT

This course introduces you to the history of art and basic practices and includes specialist physical skills in different forms of dance and is an opportunity to learn practical knowledge of performing art.

Syllabus:

Unit 1: History of Art and Common Introduction to major Dance -5hrs

I. Knowing the roots of classical dance
II. Dance forms
III. Gurus and Dance legends
IV. Various theatres
V. World dance practices
VI. Folk/ritual dance
VII. Prayer
VIII. Samam, Mandalam, Purnamandalam
IX. Basic steps, Jathis

Unit 2: General Introduction to Dance Features - 6hrs

I. Bhava and Rasa
II. ChaturvidhaAbhinaya
III. Hand Gestures
IV. Nrittam, Nrityam and Natyam
V. Practical performing art
VI. Nritta composition
VII. Nrityam composition
VIII. Natyam composition

Unit 3: Abhinaya composition and mudras -9hrs

I. Dasarupakam
II. Navarasa
III. Expressions with face muscles
IV. Mudras/hand gestures

Unit 4: Padavarnam -9hrs

I. Swarajati
II. Slokam
III. Padam
IV. Concept of Nataraja

Unit 5: Jatiswaram and Sabdam -9hrs

I. Jatiswaram
II. Sabdam
III. Thillana

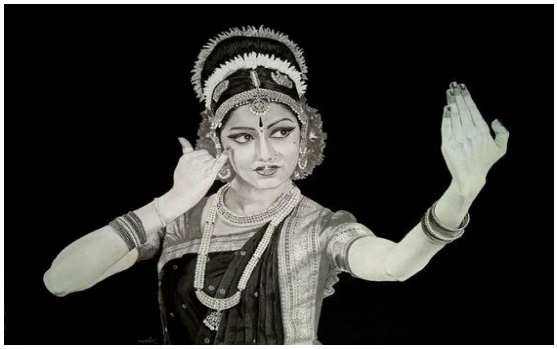
Reference Books:

1. Natyasastram Ascribed to Bharata Muni By M.M.GHOSH
2. Bharatanatyam How to : A Step-by-step Approach to Learn the Classical Form by

Jayalakshmi Eshwar

3. Hastha Prayogaah (Vocabulary of Hand Gestures in Bharatanatyam) by Jayalakshmi Eshwar

Few pictures of the course

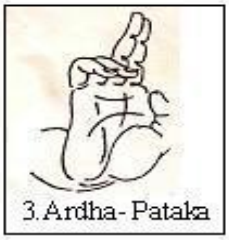





Asamyuta Hastas

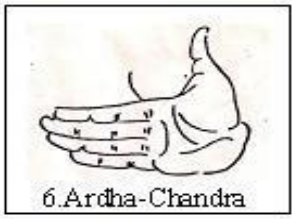

1.Pataka


2.Tri-pataka


3.Ardha-Pataka


4.Katari Mukha


5.Mayura


6.Ardha-Chandra


7.Arala


8.Sukatunda


9.Mushti


10.Sikhara

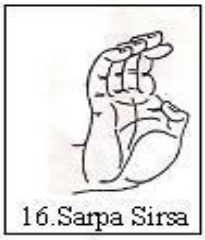

11.Kapidha

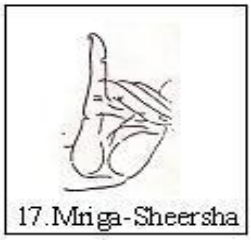

12.Kataka-Mukha


13.Suchi


14.Chandra-Kala

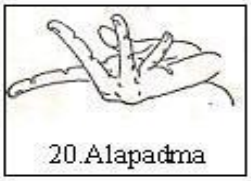

15.Padmakosha


16.Sarpa Sirsa


17.Mriga-Sheersha

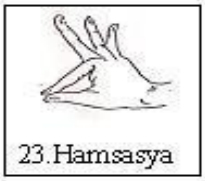

18.Simha-Mukha

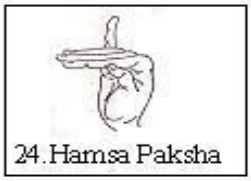

19.Kangula


20.Alapadma


21.Chatura

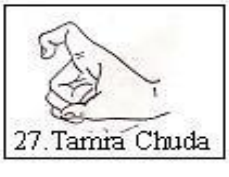

22.Bhramara


23.Hamsasya


24.Hamsa Paksha


25.Chamdamsa


26.Mukula


27.Tamra Chuda


28.Thrisula

4. STITCHING STORIES – EMBROIDERY

Syllabus:

Unit-I: (9hours)

Getting to know Embroidery Basics: Embroidery Tools & Materials -Threads, hoops and frames, Needles, Accessories - How to set up fabric and thread, - Learning simple basic hand stitches of Outline Running stitch, Back stitch, Split stitch, Chain stitch Stem stitch, - How to transfer embroidery patterns.

Unit-II: (6hours)

Discover Embroidery Patterns: Surface - straight, French knot, bullion knot, Lazy daisy, Satin - Filling& Letters - Blending embroidery floss

Unit-III: (9hours)

Learn basic hand sewing Construction: Collage - Applique techniques - Hand sewing in making a Draw string bag, Coaster

Unit-IV: (12hours)

Leave Your Stitch (Project Instructions) :

'Exploring wellbeing through Making'

How to stitch a story illustrative working with stitching techniques including Appliqué and Embroidery

Using playful imagery we will doodle pattern, enhancing simple lines, words with stitch and pretty additions in the form of using simple pattern and image sources as our starting point we will be inspired to let our imagination run away with us, adding our own interpretation to an unfolding story.

Materials Needed:

Students needs to buy their own resources to begin hand embroidery:

Fabric - cotton, linen anything you might you want to stitch on (nothing too tightly woven)

Thread - Embroidery floss or A range of colorful threads

Embroidery hoop - size #6 or #8

Scissors - small one

Needle - Size #7 #8 #9

Tracing materials : Dressmaker's carbon, pen, pencil

Common sewing machine threads for sewing

Reference Books:

1. Aneela Hoey, "Little Stitches - 100+ Sweet Embroidery Designs 12 Projects", C&T Publishing, Inc.
2. "Stitch Encyclopedia Embroidery", Sunao Onuma, Bunka publishing bureau.
3. Kristin Nicholas, "The amazing stitching handbook for kids", C&T Publishing, Inc.,

Websites for reference :

- https://www.amazon.in/designers-den-Embroidery-Ring-Frame-Hoop-Off-White/dp/B07L2Z8LGG/ref=sr_1_8?dchild=1&keywords=pony+craft+embroidery&qid=1631954553&sr=8-8
- https://www.ponycraftstore.com/item/pony-embroidery-hoop-circular-87305
- https://www.ponycraftstore.com/item/craft-compact-plain-eye-19802
- https://www.ponycraftstore.com/item/assorted-embroidery-threads-25c-4624
- https://www.youtube.com/watch?v=0sPKXULyYL0
- https://www.youtube.com/watch?v=YHllCRKwSCM
- https://www.embroidery.rocksea.org/
- https://www.embroidery.rocksea.org/reference/picture-dictionary/
- https://institchyou.com/portfolio
- https://tigleytextiles.co.uk/top-tips-for-successful-hand-embroidery/
- https://www.pdfdrive.com/doodle-stitching-the-motif-collection-400-easy-embroidery-designs-e165574858.html

5. PLAYBACK SINGING

In India, a playback singer is one who lends his or her voice for singing in feature films. Such singers are expected to be conversant with plural musical cultures; have the ability to symbolize the lyric through musical expression; and in recent years, be able to work with modern music making technologies. Over the last hundred years, playback singing has remained a dominant music production role and it continues to shape musical culture in the region.

This course introduces the student to creative music practices that are directly related to playback singing. It expounds the fundamental elements of Indian and Western musical cultures, as well as techniques for developing the students sense of musical aesthetics, his/her performance skills in the context of modern music technologies. Upon successful course completion, students will have knowledge and fundamental skills to further prepare themselves for careers related to playback singing and musical performance, in the music, media, and entertainment industries.

Syllabus:

Unit 1: Carnatic music theory — 9 hours
- Sarali Swara
- Introduction to Melakartha ragas
- Introduction to Taalam
- Arudhis and Korvais

Unit 2: Western music theory — 9 hours
- Notes and intervals
- Modes and modal structures
- Time signature and divisions
- Chords and chord progressions

Unit 3: Voice culture — 3 hours
- Vocal apparatus
- Voice quality
- Breath control
- Vocal dynamics
- Vocal modulation

Unit 4: Melody and symbolism — 9 hours
- Melodic form and structure
- Linguistic aesthetics
- Compositional symbolism
- Repertoire studies

Unit 5: Case study — 7 hours
- Identification of vocal register
- Song type and voice types
- Deconstructing a composition
- Practical project

Reference Books:

1. A Gentle Introduction to Carnatic Music - Mahadevan Ramesh - Oxygen Books, 2009
2. An Introduction to Western Music - Rev. Dr. M.P.GEORGE - State Institute of Languages, 2015
3. Voice Culture Made Easy - J Louis Orton - Forgotten Books, 2018

6. ORGANIC FARMING

Syllabus:

Unit-I: Soil & Origin of farming - 6 hrs

Introduction to Soil, Soil Horizons, Components of Soil, Factors influence on soil, Climatological influence, Types of Soils. Farming and it's origin.

Unit-II: Traditional Agriculture & Present Agriculture - 5 hrs

Traditional Agriculture -Origin of Farming. Introduction to Traditional Agriculture**,** Characteristics**,** Different names of Farming Method**,** Advantages**,** Impact on Environment**,** Primitive subsistence farming.

Present Agriculture**-** Green Revolution in India Down fall, Need to Overcome Food Shortage, Negative Impacts in India.

Unit-III: Why Organic - 8 hrs

Introduction, Consideration for Conversion to Organic Agriculture, Step-by-step conversion, GMO, Advantages, Disadvantages.

Externalities, Issues, Pesticides, Food quality and safety, Soil conservation, Biodiversity

Unit-IV: Organic manures - 8 hrs

Introduction, Major organic sources and transformations, Chemical nature of organic matter and its decomposition, Chemical composition of organic matter, Types of Manures, Biofertilizers

Neem and it's agricultural applications -Applications of neem**,** Their benefits**,** Mode of action**,** Chemistry of neem.

Unit-V: Farming through organic - 6 hrs

Methods, Crop diversity, Soil management, Weed Management, Controlling other organisms, Livestock, Genetic modification.

Unit-VI: Status, prospects and challenges of organic farming in India -7hrs

Present status of organic farming in India, Opportunities in organic farming, Challenges of organic farming, Strategies to promote organic farming in India.

Text Books :

1. Rana, S.S., 2016. Organic Farming, CSK Himachal Pradesh KrishiVishvavidyalaya, Palampur.
2. MamtaBansal, 2020. Basics of Organic Farming, CBS Publihers and Distributors Pvt.Ltd., New Delhi.

3. Palaniappan, S.P., & .Annadurai, 2016.Organic Farming : Theory and Practice, Scientific Publishers, Jodhpur.
4. Reddy, S.R., 2017. Principles of Organic Farming, Kalyani Publishers, New Delhi.

REFERENCES:

1. https://www.britannica.com/topic/origin-of-farming
2. www.jagranjosh.com/traditional-farming
3. https://www.geographyandyou.com/a-critical-review-of-green-revolutiion-in-india
4. https://www.britannica.com/topic/organic-farming
5. http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Compilation techniques_organic_agriculture_rev.pdf
6. http://www.jbiopest.com/users/LW8/efiles/Vol_5_0_72_76F.pdf
7. http://www.agademy.in/2019/06/status-of-organic-farming-in-india-prospects-and-challenges/
8. https://nptel.ac.in/ courses/126/105/126105014/#

7. DESIGN THINKING

Syllabus:

Part – A

UNIT-I: **5hrs**

Design Thinking Background: Definition of Design Thinking, Business uses of Design Thinking, Variety within the Design Thinking Discipline, Design Thinking Mindset.

UNIT-II: **5hrs**

Design Thinking Approach: Fundamental Concepts - Empathy, Ethnography, Divergent Thinking, Convergent Thinking, Visual Thinking, Assumption Thinking, Prototyping, learning and validation

UNIT -III: **6hrs**

Design Thinking in Practice: Design Thinking tools and methods - Purposeful use of tools and alignment with process, What Is - Visualization, Journey mapping and Mind Mapping, What If - Brainstorming, What WOWs - Assumption testing, Rapid Prototyping, What Works - Customer Co-Creation.

Part – B

Tasks to be done:

Go through all stages of the methodology and Engage with surrounding environment to identify a design challenge

Task 1: Empathizing **6hrs**

- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 2: Ideating **6hrs**

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Part – C

Task 3: Prototyping **7hrs**

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 4: Report **6hrs**

Final Report Submission and Presentation

Text Books :

1. Tom Kelly, The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm (Profile Books, 2002)
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)

References:

1. Human-Centered Design Toolkit (IDEO); https://www.ideo.com/post/design-kit
2. Design Thinking Boot Camp Bootleg (Stanford D-School); https://dschool.stanford.edu/resources/the-bootcamp-bootleg
3. Collective Action Toolkit (frogdesign);

https://www.frogdesign.com/wpcontent/uploads/2016/ 03/CAT_2.0_English.pdf
4. Design Thinking for Educators (IDEO); https://designthinkingforeducators.com/

8. DESKTOP MUSIC PRODUCTION

Desktop music production is the art of utilizing digital music related technologies to produce professional sounding and expressive musical audio. This involves the combined application of musical and technological skills through the use of specialized hardware and software resources. It is noteworthy to mention here that today; desktop music production dominates music making practices around the world and is also a main contributing factor towards the homogenization of contemporary popular music.

This course introduces the student to producing music using desktop digital technologies. It expounds the fundamental elements of music such as melody, harmony and rhythm, as well as technological skill sets, that are central to contemporary music production practices around the world. Upon successful course completion, students will have skills for a wide range of careers related to music creation, music programming and music production, in the music, media, and entertainment industries.

Syllabus:

Unit 1: Introduction to DAW — 6 hours
- Session parameters
- Tracks and regions
- Global parameters
- Tools and inspectors

Unit 2: Fundamental music theory — 6 hours
- Notes and intervals
- Modes and modal structures
- Time signature and divisions
- Chords and chord progressions
- Introduction to standard music notation

Unit 3: Introduction to MIDI — 4 hours
- History of MIDI
- MIDI parameters
- Ports and channels
- MIDI hardware and connectivity

Unit 4: Music sequencing — 12 hours
- MIDI recording

- Step sequencing
- Quantisation
- MIDI parameters and music expression
- Instrument specific techniques

Unit 5: Working with VSTs 12 hours

- Instrument registers
- Keyswitches and articulations
- Working with Maschine
- Working with Komplete Kontrol

Reference Books:

1. Logic Pro X - How it Works: A new type of manual - the visual approach - Edgar Rothermich - CreateSpace Independent Publishing Platform; Illustrated edition, 2013
2. Synthesizer Explained: The Essential Basics of Synthesis You Must Know as a Digital Music Producer (Electronic Music and Sound Design for Beginners: Oscillators, Filters, Envelopes & LFOs) - Screech House
3. Digital Sampling: The Design and Use of Music Technologies - Paul Harkins - Routledge; 1st edition, 2019.

9. FOOD TECHNOLOGY

Syllabus:

Unit-I: FOOD BASICS 8hrs

Food Chemistry: Introduction to food, Food composition- Carbohydrates, Proteins, Lipids, Dietary fibres, Minerals, Vitamins.
Food Microbiology: Introduction, Food spoilage, factors affecting spoilage.

Unit-II: FOOD PROCESSING 10hrs

Ambient temperature processing/Primary processing, thermal processing, Low temperature processing, equipments, effect of processing on nutritional properties.

Unit-III: FOOD PRESERVATION 10hrs

Principles of food preservation, Different methods of preservation, equipments, effect on nutritional properties of food.

Unit-IV: FOOD PACKAGING 10hrs

Introduction, functions of packaging, different types of packaging, types of packaging materials.

Reference Books:

1. Food Processing Technology- Principles and Practice by P.J. Fellows
2. Food Processing and Preservation by G Subbalakshmi, Shobha A Udipi
3. Food Microbiology (4th edition) by W. C Fraizer
4. Food packaging by G.L. Robertson
5. Hand Book of Food Engineering by D.R. Heldman and D.B.Lund
6. Fundamentals of Food Engineering (2010) by D.G. Rao.
7. Introduction to Food Engineering (5th edition) by R. P. Singh *et al*.

Course Outcomes:

Upon completion of this course, the students will be able to:
CO1: Demonstrate basic proficiency in particular art form.
CO2: Learn social competencies to become self-reliant and resourceful.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	3	3	3	3	3	3	-	3
CO2	-	-	-	-	3	3	3	3	3	3	-	3

ENVIRONMENTAL SCIENCE

Subject Code: UGBS3A0322	**L**	**T**	**P**	**C**
II Year / I Semester	**2**	**0**	**0**	**0**

Prerequisites: Basic knowledge on Eco systems, bio diversity and environmental pollution.

Course Objectives:

The course emphasized a basic understanding of the ecosystem and its diversity. Introduces different environmental technologies to mitigate the adverse impacts of environmental pollution. It creates awareness of global treaties with a broader context. Further, familiarizes the basic concepts of disaster management.

Syllabus:

UNIT-1: Ecosystem and Biodiversity (6 Hours)

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance concept of ecosystem, Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem Food chains, food webs. Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-2: Natural Resources: Natural Resources and Associated Problems (5 Hours)

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT-3: Environmental Pollution & Technology (4Hours)

Environmental Pollution - Air, water, soil, noise, plastic pollution - sources, effects, Environmental carcinogens - types, sources of ionizing radiation, global climatic challenges.

Environmental Technology- Water pollution management - Waste water treatment, air pollution - control measures, solid waste management, methods to hazardous waste collection and treatment of hazardous waste, bio-medical waste management, and technical solutions for plastic waste.

UNIT-4: Environmental Management And Sustainable Development

(4 Hours)

Environmental standards in India, Environmental legislation acts, Environmental assessment (EA), Environmental management plan, Carbon credits under KYOTO, IPCC, UNFCC, National and international plans for climatic change.

UNIT-5: Disaster Management **(4 Hours)**

Disaster Management, identification of disaster-prone areas, disaster warning programs. Eco tourism - Student should go field visit and have to submit a report for evaluation.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain different types of ecosystem services and provide examples of ultimate and proximate threats to biodiversity and ecosystem integrity.

CO2: Recognize the different aspects of environmental contamination, which have adverse effects on human health.

CO3: Evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the restoration of degraded environments.

CO4: Identify and justify key stakeholders in humanities and social sciences that need to be a part of sustainable solutions.

CO5: Describe the findings and critically analyze various aspects that are relevant to environmental studies during a field trip.

CO6: Asses impact of disasters and environmental hazards with emphasis on disaster preparedness, response and recovery.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	-	-	-	-	2
CO2	-	-	-	-	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	3	3	-	-	-	-	2
CO4	-	-	-	-	-	-	3	-	-	-	-	2
CO5	-	-	-	-	-	3	-	-	-	3	-	2
CO6	-	-	-	-	-	3	3	-	-	-	-	-

TEXT BOOKS:

1. Environmental Studies by R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
2. A Textbook of Environmental Studies by Shashi Chawla, TMH.
3. Environmental Studies by P.N. Palaniswamy, P. Manikandan, A. Geeth Enviroa, and K. Manjula Rani; Pearson Education.

REFERENCE BOOKS:

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers.
3. Environmental Studies by Benny Joseph, Tata McGraw Hill Co.
4. Environmental Studies by Piyush Malaviya, Pratibha Singh, Anoop Singh: Acme Learning.

II B.Tech.
II Semester

TRANSMISSION AND DISTRIBUTION

Subject Code: UGEE4T0122	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**-**	**-**	**3**

Prerequisites: Electrical circuits, Electromagnetic Fields

Course Objective: Electrical Power plays significant role in day to day life of entire mankind. The aim of this course is to allow the students to understand the concepts of the generation and transmission of power along with economic aspects. It also deals with basic theory of transmission lines modeling their performance analysis, Distribution system and improvement of power factor and voltage control.

Syllabus:

UNIT – I: Transmission Line Parameters (9 Hours)

Resistance, inductance and capacitance of single and three phase transmission lines-symmetrical and unsymmetrical spacing–transposition-single and double circuits-stranded and bundled conductors-application of self and mutual GMD–Skin and Proximity effect - Inductive interference – Corona – characteristics- factors affecting corona, critical voltages and power loss

UNIT – II: Performance of Transmission Lines (9 Hours)

Development of equivalent circuits for short, medium and long lines–efficiency and Regulation-Attenuation constant and phase constant- surge impedance loading

UNIT – III: Mechanical design of Transmission line (9 Hours)

Insulators–types and comparison–voltage distribution in string insulator–string efficiency–Methods of improving string efficiency–

Stress and sag calculations–effect of wind and ice–supports at different levels–stinging chart.

UNIT – IV: General Concepts and Distribution Feeders (9 Hours)

Introduction to distribution systems, Classification of Distribution Systems - design features of distribution systems, radial distribution, ring main distribution, Feeder loading – Basic design practice of the secondary distribution system– 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

UNIT – V: Power Factor Improvement & Voltage Control (9 Hours)

Capacitive compensation for power factor control – Methods of Improving PF - Power factor correction – Capacitor allocation – Effect of shunt capacitors (Fixed and switched) - Most economical PF for constant KW load and constant KVA type loads - Procedure to determine the best capacitor location.

Necessity of voltage control in power system-methods for voltage control – Effect of series capacitors– Effect of AVB/AVR –Line drop compensation

Course Outcomes: At the end of this course, students will be able to

CO1: Determine the parameters of various types of transmission lines

CO2: Analyze the performance of short, medium and long transmission lines

CO3: Analyze mechanical design of transmission lines

CO4: Understand the concepts of distribution systems and distribution feeders

CO5: Classify and compare different type of insulators and underground cables

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

TEXT BOOKS:

1. Electrical Power Systems by C. L. Wadhawa New Age International (P) Limited, Publishers, 1997
2. Electrical Power Systems by P.S.R. Murthy, B.S. Publications
3. Electrical Power Systems by D. Das, New age International
4. Electric Power Distribution system, Engineering" – by Turan Gonen, McGraw–hill Book Company.

REFERENCE BOOKS:

1. Electrical Power Distribution &Automation by S.Sivanagaraju & V.Shankar, Dhanpat Rai & Co
2. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.

PROBABILITY AND STATISTICS

Subject Code: UGBS4T0322	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Syllabus:

Unit-I: Basic Probability (10 Hours)

Introduction to Probability, Conditional Probability, Baye's Theorem on Probability; Random Variables: Discrete and continuous - Probability function – density and distribution function, Expectation of a Random Variable

Unit-II: Probability Distributions (10 Hours)

Probability distributions: Binomial, Poisson and Normal - Evaluation of statistical parameters: Mean, Variance and their properties

Unit-III: Correlation and Curve fitting (12 Hours)

Correlation coefficient – rank Correlation- Regression coefficients and properties-Regression lines-

Method of Least squares- Fitting of straight line, parabola, Exponential and power curves

Unit-IV: Sampling Distribution and Estimation (10 Hours)

Introduction –Sampling distribution of means with known and unknown standard deviation

Estimation: Criteria of a good estimator, point and interval estimators for means and proportions

Unit-V: Tests of Hypothesis (12 Hours)

Introduction-Type-I, Type-II Errors, one–tail, two-tail tests, Large sample test for single proportion, difference of proportions, single mean, difference of means.

Small sample test for single mean, difference of means. Test for ratio of variances - F-Test, Chi-square test for goodness of fit and independence of attributes.

Course Outcomes:

CO1: Apply basic theorems of probability and examine the random variable to solve real time Problems(L3)

CO2: Classify the probability distribution involved in a given problem and examine the relevant probabilities and parameters(L3)

CO3: Construct a suitable curve to the given data using least squares methods and Determine correlation between two variables (L4)

CO4: Demonstrate the concepts of sampling distribution and statistical estimation(L3)

CO5: Apply the principles of hypothesis testing to draw conclusions about real time Data(L3)

Mapping of COs to POs:

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

TEXTBOOKS:

1. Probability and Statistics for Engineers, Miller, John E. Freund, PHI
2. Probability and Statistics, Dr.T.S.R.Murthy, I.K. International Publishing
3. Fundamentals of Mathematical Statistics, S.C.Gupta&V.K.Kapoor, Sultan Chand.
4. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Sharon L. Mayers and Keying Ye, Pearson Education.

REFERENCE BOOKS:

1. Probability, Statistics and Random Processes, Murugesan :Anuradha Publishres.

2. Fundamentals of Statistics, S.C.Guptha, Himalaya Publishing.

ANALOG INTEGRATED CIRCUITS

Subject Code: UGEE4T0222	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Electrical circuits, Analog Electronics

Course Objective: The objective of this course is to introduce the basic building blocks of the Linear Integrated circuits, and applications on Linear & Non-linear Op-amps. To study the special functions of PLL, Linear IC's and Digital IC's and theory about the ADC and DAC.

Syllabus:

UNIT –I: Introduction to Operational Amplifier (10 Hours)

Introduction to Operational Amplifier-Block diagram of Typical Op-Amp with Various Stages-circuit symbol- BJT Differential Amplifier -Different input/output configurations of BJT differential amplifier-DC and AC Analysis of BJT Differential Amplifier with RE - AC analysis with r-parameters-BJT differential amplifier Analysis with constant current source-Current mirror circuit-Level translator-Cascaded BJT differential amplifier-FET differential amplifier.

UNIT –II: Operational Amplifier Characteristics & IC Voltage Regulators (10 Hours)

Operational Amplifier Characteristics: Ideal operational amplifier properties–Ideal assumptions-equivalent circuit-virtual ground-OPAMP Parameter; Input bias current - Input offset Current-Input Offset Voltage-Differential input resistance-CMRR-PSRR-Slew ratio–Large signal voltage gain–Output voltage swing transient's response. OPAMP with open loop and closed loop configurations Basic circuits such as differential, inverting and non-inverting.

IC Voltage Regulators: Basic Voltage Regulators-IC voltage regulators using 78XX-79XX -Dual power supplying using 78XX and 79XX series

UNIT –III: Operational Amplifier Applications & Design of Active Filters (12 Hours)

Operational Amplifier Applications

OPAMP as voltage follower-summing Amplifier - Non-inverting summing amplifier-subtractor-Differentiator-Integrator-Instrumentation Amplifier-V to I and I to V Convertors-Log and Antilog amplifiers–non-inverting type comparator–Inverting type Comparator-Zero crossing detector–Schmitt-trigger sample and hold circuit-peak Detector Precision Diode-Half-wave and full-wave rectifiers.

Active Filters: Active filters (Butter-Worth) Introduction-Merits and demerits of active filters Over Passive Filters First order low pass filter Design and frequency Response-First order HPF design and frequency Response-BPF-wide band-pass and narrow band–pass Filter-Wide band reject Filter-Notch Filter-All-pass filter.

UNIT –IV: Waveform Generators Using Op-Amp, Timers & PLL (10 Hours)

OPAMPS: Wave form generators using op–amps: square wave & triangular wave, Design of Astable multi vibrator –Monostable multivibrator using signal op-amp

555 TIMERS: Introduction-Pin diagram-Functional diagram for 8pin DIP-Design of Astable and monostable multivibrators-Astable application as voltage controlled oscillator-Monostable application as pulse width modulation

PLL: Introduction, block diagram-Function of each block 565 PLL-PLL Applications as Frequency divider andfrequency multiplier

UNIT –V: D to A and A to D converters (10 Hours)

D to A and A to D Convertors; Digital to Analog Convertors (D to A)-Introduction-Specifications-Basic DAC techniques- Weighted resistor DAC R–2R ladder DAC-Invested R-2R Output expression for each type. Analog to Digital Convertors Introduction-Specifications-Parallel comparator type-Counter Type-Dual Slope-Successive approximation type ADCs- Merits and demerits of each type, Comparison of different types.

Course Outcomes: At the end of this course students will be able to

CO1: Explain internal operation and characteristics of different configurations of

CO2: Acquaint with a wide variety of op-amps to develop linear and digital IC

CO3: Develop and distinguish various analog filter configurations based on frequency

CO4: Classify and develop wave form generators using op-amp, 555 timer and PLL

CO5: Construct and compare different A to D and D to A conversion operation

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	2											3	
CO2	1	2									3		3	
CO3	1	2			3						3		2	
CO4	1	2			3						3		2	
CO5	1	2			3						3		3	

Text Books:

1. "Op-Amps and Linear Integrated Circuits", Ramakanth A Gayakwad, Vol 1, 4th Edition, Pearson Education, 2000,
2. "Linear Integrated Circuits", D Roy Chowdary, Vol 1, 2nd Edition, New Age International, 2003.

REFERENCE BOOKS:

1. "Op-Amps and Linear Integrated Circuits", Dr Sanjay Sharma, Vol 1, 4th Edition, S K Kataria& Son's, 2017
2. "Analog Electronics", L K Maheswari& M M S Anand, Vol 1, 1st Edition, Prentice Hall India Pvt Ltd, 2006
3. "Linear Integrated Circuits", S Salivahan& V S KanhanaBhasskaran, Vol 1, 1st Edition, Tata McGraw Hill PublishingCompany Ltd, 2008
4. "Electronic Principles", Albert Malvino and David J Bates, Vol 1, 8th Edition, Mc Graw Hill Edition, 2015

POWER ELECTRONICS

Subject Code: UGEE4T0322	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**-**	**-**	**3**

Prerequisites: Electrical circuits, Electronic devices

Course Objective: To understand and acquire knowledge to analyze and design different power converter circuits with R, RL loads.

Syllabus:

UNIT –I: Single Phase AC–DC Bridge Converters (10 Hours)

Single Phase: Dynamic characteristics of SCR – Snubber circuit design, Line commutation principle using fully controlled and semi controlled converter operations with R, RL loads – Derivation of average voltage and current – Effect of source Inductance.

UNIT –II: Three Phase AC–DC Bridge Converters (10 Hours)

Three Phase: Full and semi converter with R and RL loads – Derivation of load voltage, Dual converters with non–circulating and circulating currents, Numerical Problems.

UNIT –III: DC–DC Converters (10 Hours)

Buck Converter operation – Voltage and current waveforms – Derivation of output voltage.
Boost converter operation – Voltage and current waveforms – Derivation of output voltage.
Buck-Boost converter operation – Voltage and current waveforms – Derivation of output voltage.
Cuk converter/Regulator operation - Voltage and current waveforms.

UNIT – IV: AC–AC Converters (12 Hours)

Principles of ON-OFF Control, Single phase AC voltage controller with R and RL load, derivation of RMS output voltage – Numerical problems – Operation of three phase AC voltage controller (Start and Delta Configurations), Synchronous tap changers operation.

UNIT –V: DC–AC Inverters (10 Hours)

Single phase half bridge and full bridge inverters – Three phase Inverters (120^0 and 180^0 modes of operation) – PWM techniques – single pulse, multi-pulse and sinusoidal PWM. Multi level inverters - Multilevel Concept, Types of Multilevel Inverters, features and advantages.

Course Outcomes: At the end of this course students will be able to
CO1: Analyze the performance of single and three phase AC-DC converters
CO2: Examine the performance of AC-AC converters
CO3: Examine the performance of DC-DC converters
CO4: Examine the performance of DC-AC converters

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	-	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	3	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	3	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	3	-	-	-	-	-	-	-	-	-	-	3

TEXT BOOKS:

1. "Power Electronics: Circuits, Devices and Applications ''– by M. H. Rashid, 2nd edition, Prentice Hall of India, 1998
2. "Power Electronics: converters, applications & design -by Ned Mohan", Tore M. Undeland, Robbins by Wiley India Pvt. Ltd.
3. "Power Converter Circuits" -by William Shepherd, Li Zhang, CRC Taylor & Francis Group.
4. Fundamentals of Electric Drives – by G K Dubey Narosa Publications.

REFERENCE BOOKS:

1. "Elements of Power Electronics"–Philip T. Krein. Oxford publications.
2. "Power Electronics" – by P.S. Bhimbra, Khanna Publishers.
3. "Thyristorised Power Controllers" – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K. Sinha, New Age International (P) Limited Publishers, 1996.
4. Power Electronics handbook by Muhammad H. Rashid, Elsevier.
5. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications.

UNIVERSAL HUMAN VALUES
(Common to all branches)

Subject Code: UGBS4T0122	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Course Objectives:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2. To facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the human reality and the rest of existence.

3. To highlight plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with nature.

Syllabus:

UNIT-I: Introduction to Value Education (6 hours)

Right Understanding, Relationship and Physical Facility; Understanding Value Education; Self-exploration as the Process for Value Education; Continuous Happiness and Prosperity – the Basic Human Aspirations; Happiness and Prosperity – Current Scenario; Method to Fulfill the Basic Human Aspirations.

Practice Sessions: Sharing about Oneself; Exploring Human Consciousness; Exploring Natural Acceptance.

UNIT-II: Harmony in the Human Being (7 hours)

Understanding Human being as the Co-existence of the Self and the Body; Distinguishing between the Needs of the Self and the Body; The Body as an Instrument of the Self; Understanding Harmony in the Self; Harmony of the Self with the Body; Programme to ensure self-regulation and Health.

Practice Sessions: Exploring Harmony of Self with the Body; Exploring Sources of Imagination in the Self; Exploring the difference of Needs of Self and Body.

UNIT-III: Harmony in the Family and Society (7 hours)

Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' – as the Right Evaluation; Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society; Vision for the Universal Human Order.

Practice Sessions: Exploring the Feeling of Trust; Exploring the Feeling of Respect; Exploring Systems to fulfil Human Goal.

UNIT-IV: Harmony in the Nature/Existence (6 hours)

Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature; Realizing Existence as Co-existence at All Levels; The Holistic Perception of Harmony in Existence.

Practice Sessions: Exploring the Four Orders of Nature; Exploring Co-existence in Existence.

UNIT-V: Implications of the Holistic Understanding – A Look at Professional Ethics (7 hours)

Natural Acceptance of Human Values; Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order; Competence in Professional Ethics; Holistic Technologies, Production Systems and Management Models-Typical Case Studies; Strategies for Transition towards Value-based Life and Profession.

Practice Sessions: Exploring Ethical Human Conduct, Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Evaluate the significance of value inputs in formal education and start applying them in their life and profession.

CO2: Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.

CO3: Analyse the value of harmonious relationship based on trust and respect in their life and profession.

CO4: Examine the role of a human being in ensuring harmony in society and nature.

CO5: Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	3	-	3	3	-	-	-
CO2	-	-	-	-	-	3	-	3	3	-	-	-
CO3	-	-	-	-	-	3	-	3	3	-	-	-
CO4	-	-	-	-	-	3	3	3	3	-	-	-
CO5	-	-	-	-	-	3	-	3	3	-	-	-

TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics" Excel Books, New Delhi, 2019

2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2019.

REFERENCE BOOKS:

1. A.N. Tripathi, "Human Values", New Age Intl. Publishers.

2. A. Alavudeen, R. Kalil Rahman and M. Jayakumaran, "Professional Ethics and Human Values",Laxmi Publications.

3. A.R. Aryasri, Dharanikota Suyodhana, "Professional Ethics and Morals", Maruthi Publications.

4. M. Govindarajan, S. Natarajan and V.S. Senthil Kumar, "Engineering Ethics includes Human Values", PHI Learning Pvt. Ltd

5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

ANALOG ELECTRONICS LAB

Subject Code: UGEE4P0422	**L**	**T**	**P**	**C**
II Year / II Semester	**0**	**0**	**3**	**1.5**

List of Experiments

Section A: DIODE AND TRANSIOTOR APPLICATIONS (Any 4 Experiments)

1. Bridge Rectifier (with filter and without filter)
2. Non Linear Wave Shaping – Clippers
3. Non Linear Wave Shaping – Clampers
4. Transistor as a switch
5. Design and verify Self Bias Circuit.
6. Astable Multivibrators (Voltage – Frequency Converter)

SECTION B: LINEAR IC APPLICATIONS (Any 6 Experiments)

1. Op-Amp Applications
    a. Adder
    b. Subtractor
2. Integrator Circuit using IC741.
3. Differentiator Circuits using IC741.
4. Active Filter Applications: HPF (first order).
5. IC741 Oscillator Circuit: RC Phase Shift Oscillator.
6. IC 555 Timer: Astable Operation Circuit.
7. Monostable Operation Circuit using Op-Amp or 555 Timer.
8. 4 bit DAC using OP-AMP

Course Outcomes: At the end of this course students will be able to

CO1: Having knowledge to design various applications using diodes and Transistors.

CO1: Having knowledge to solve mathematical problems and conversions using IC-741.

CO2: Develop and verify the frequency response of active filters, oscillators and timing

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	-	-	3	3
CO2	-	-	-	-	-	-	-	2	2	-	-	-	3	-
CO3	-	-	-	-	-	-	-	-	2	2	-	-	-	3

ELECTRICAL MACHINES- II LAB

Subject Code: UGEE4P0522	**L**	**T**	**P**	**C**
II Year / II Semester	**0**	**0**	**3**	**1.5**

List of Experiments

Any ten of the experiments from the following are to be conducted.

1. O.C. & S.C. Tests on Single Phase Transformer

2. Sumpne's test on single phase Transformers

3. Scott connection of Transformers

4. No–load & Blocked rotor tests on three phase Induction motor

5. Regulation of a three-phase alternator by synchronous impedance method

6. **V** and Λ curves of a three-phase synchronous motor.

7. Equivalent Circuit of a single-phase induction motor

8. Determination of **Xd** and **Xq** of a salient pole synchronous machine

9. Parallel operation of Single-phase Transformers

10. Separation of core losses of a single-phase transformer

Additional Experiments

11. Brake test on three-phase Induction Motor

12. Measurement of sequence impedance of a three-phase alternator.

Course Outcomes: At the end of this course students will be able to

CO1: Examine the performances of single-phase transformer by conducting suitable test
CO2: Understand the separation of core-losses in transformer

CO3: Analyze the behaviour of Induction Machines

CO4: Experiment with synchronous machines for deliberate its performance

Mapping of COs to POs :

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1			3	3								2		
CO2			3	3								2		
CO3			3	3								2		
CO4			3	3								2		

DIGITAL LOGIC CIRCUITS LAB

Subject Code: UGEE4P0622	**L**	**T**	**P**	**C**
II Year / II Semester	**0**	**0**	**3**	**1.5**

Course Objective:

To provide hand-on experience in designing and implementing digital/logic circuits. The laboratory exercises are designed to give students ability to design, build, and implement digital circuits and systems. Laboratory exercise progress from investigation of the properties of basic logic gates and flip-flops to the design of combinational and sequential circuits.

Syllabus

List of Experiments

Any Ten of the below Experiments can be conducted

1.(a) Study of Logic gates

(b) Verify DE Morgan's Theorem for 2 variables.

2. Simplification of K-Maps
3. Design and Implementation of Code Converters using logic gates
4. Design and Implementation Arithmetic circuits
5. Design and Implementation of Decoders and Encoders
6. Design and Implementation of MUX and DE-MUX
7. Design and Implementation of Magnitude comparator
8. Verify State tables of Flip Flops
9. Design and Implementation of Registers
10. Design and Implementation of Counters
11. Design and Implementation of Decoder Applications
12. Design and Implementation of Multiplexer Applications

Course Outcomes: At the end of this course students will be able to
CO1: Verify De Morgan's Theorem and K-Maps using various logic gates

CO2: Design and implementation of code converters using logic gates

CO3: Design and implementation of combinational and sequential logic circuits

CO4: Develop technical writing skills and effective communication
CO5: Acquire teamwork skills for working in groups

Mapping of COs to POs :

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1				3										
CO2				3										
CO3				3										
CO4										3				
CO5									3					

SCIENTIFIC COMPUTING LAB

Subject Code: UGEE4K0722	**L**	**T**	**P**	**C**
II Year / II Semester	**1**	**0**	**2**	**2**

List of Experiments

1. Basics of MATLAB:Creating and working with arrays of numbers-Creating and printing simple plots- saving and executing a script file- creating and executing a function file
2. Arrays and Matrices-I: Matrices and vectors-input, indexing, matrix manipulation, creating vectors-arithmetic operations
3. Arrays and Matrices-II:relational operations, logical operations-elementary math functions, matrix functions
4. Programming: Relational and logical operators- Control structures- for Loop-Nested for Loops- While Loops
5. Scripts and functions: User defined functions- functions that returnmore than one value-subfunction- Menu driven programming
6. Graphics & GUI:Basic 2-D plots- 3-D plots- GUI

Course Outcomes: At the end of this course students will be able to

CO1: Explain the basics of MATLAB

CO2: Interpret the given problem and write an appropriate programs using MATLAB m-file

CO3: Choose appropriate mathematical and logical operations for the given problem-solving scenario

CO4: Solve engineering problem by using appropriate user-defined functions

CO5: Identify suitable plotting functions and develop Graphical user interface for visualizing and communicating the results

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3		3	3									
CO2	3	3		3	3									
CO3	3	3		3	3									
CO4	3	3		3	3									
CO5	3	3		3	3									

REFERENCES:

1. https://in.mathworks.com/academia/courseware.html

Electric Vehicular Drives

Subject Code: UGEE5T0122	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**-**	**-**	**3**

Course Objective:

To impart knowledge about fundamentals of Electric drives and control, operational strategies of dc and ac motor drives and quadrant operations.

Syllabus

UNIT –I	**DC motor characteristics**	**Hours: 08**
review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed.		
UNIT –II	**Chopper fed DC drive**	**Hours: 08**
Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripples, smooth starting.		
UNIT –III	**Multi-quadrant DC drive**	**Hours: 06**
Review of motoring and generating modes of operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers.		
UNIT –IV	**Scalar control or constant V/f control of induction motor**	**Hours: 10**
Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, and constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit.		
UNIT –V	**Control of slip ring induction motor**	**Hours: 08**
Operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.		

Course Outcomes: At the end of this course students will be able to
CO1: Illustrate the performance of DC motor characteristics.
CO2: Analyze the control and operation of DC motor fed by Chopper.
CO3: Examine the performance of Multi-quadrant DC drive.
CO4: Apply the knowledge of Three Phase VSI fed induction motor drive and analyze its performance for different modulation strategies.
CO5: Analyze the performance of slip ring induction motor control.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1			2											3
CO2	2	3	3											3
CO3	2		3											3
CO4	2		3											3
CO5	2	3	3											3

Text Books:

1. "Power Semiconductor Controlled Drives", G. K. Dubey, by Prentice Hall, 1989.
2. "Electric Motor Drives: Modeling, Analysis and Control", R. Krishnan, by Prentice Hall, 2001.
3. "Fundamentals of Electrical Drives", G. K. Dubey, by CRC Press, 2002.

Reference Books:

1. "Control of Electric Drives", W. Leonhard, by Springer Science & Business Media, 2001.

ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Subject Code: UGEE5T0222	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**-**	**-**	**3**

Prerequisites: Basic knowledge on electrical & electronic measuring instruments, Electrical Circuits, Vector Algebra.

Course Objective: This course introduces principle of operation of basic analog and digital measuring instruments for measurement of current, voltage, power, energy etc. Measurement of resistance, inductance and capacitance by using bridge circuits will be discussed in detail. It is expected that student will be thorough with various measuring techniques that are required for an electrical engineer.

Syllabus

UNIT –I	**ANALOG AMMETERS AND VOLTMETERS**	**Hours: 10**
Classification-Deflecting, control and damping torques – PMMC, Moving Iron type, Dynamometer type and electrostatic instruments- Construction, Torque equation, Range extension, errors and compensation- Instrument Transformers-Ratio and phase angle errors – Numerical problems.		
UNIT –II	**MEASUREMENT OF POWER, ENERGY AND POWER FACTOR**	**Hours: 10**
Electrodynamometer type wattmeter - construction, Torque equation, errors - LPF wattmeter - Measurement of Active and Reactive power in polyphase systems – Numerical problems. Single-phase Induction type meters- construction, theory and operation – errors and compensations – Numerical problems. Types of P.F. meters-Dynamometer and Moving iron type.		
UNIT –III	**MEASUREMENTS OF PARAMETERS (R-L-C) & POTENTIOMETERS**	**Hours: 18**
Measurement of resistance(R): Measurement of low, medium and high resistances –Wheat stone's bridge – Kelvin's double bridge – Loss of charge method– Megger- Measurement of earth resistance. Measurement of inductance(L): Maxwell's bridge–Hay's bridge – Anderson's bridge–Owen's bridge. Measurement of capacitance(C): Desauty Bridge – Schering Bridge- Numerical problems. DC Potentiometer: Principle and operation– Standardization –Applications. AC Potentiometers: Working of polar and coordinate types-Applications.		
UNIT – IV	**DIGITAL METERS**	**Hours: 09**
Digital voltmeter – Successive approximation DVM, Ramp type DVM and Integrating type DVM – Digital frequency meter, Digital multimeter, Digital tachometer, Digital Energy Meter, LCR Q meter, Power Analyzer- Measurement of phase difference, Frequency, hysteresis loop using lissajious patterns in CRO- Numerical Problems.		
UNIT –V	**TRANSDUCERS**	**Hours: 09**
Definition, Classification, Resistive, Inductive and Capacitive Transducer, LVDT, Strain Gauge, Thermistors, Thermocouples, Piezo electric and Photo Diode Transducers, Digital shaft encoders, Hall effect sensors- Numerical Problems.		

Course Outcomes: At the end of this course students will be able to:

CO1: Categorize electrical instruments for measuring various electrical quantities and analyze their performances.

CO2: Illustrate the working of different meters for power, energy and power factor.

CO3: Understand the operation various bridges for measurement of electrical parameters (R, L, C) and principle of operation and working of DC & AC Potentiometers.

CO4: Understand the principle of operation and working of Digital meters & transducers.

CO-PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3											1	1
CO3	3	3											1	1
CO4	3	3											1	1

TextBooks

1. "Electrical & Electronic Measurement & Instruments" by A. K. Sawhney, Dhanpat Rai & Co. Publications, 2015.
2. "Electrical Measurements and measuring Instruments" by E. W. Golding and F. C. Widdis, 5thEdition, Wheeler Publishing. 1998
3. "Modern Electronic Instrumentation and Measurement Techniques" A.D. Helfrick and W.D. Cooper, 5th Edition, PHI Learning Private Ltd., 2002.

ReferenceBooks:

1. "Electrical and Electronic Measurements" by Banerjee, Gopal Krishna, 2nd edition, PHI Learning Private Ltd., 2016.
2. "Electrical Measurements: Fundamentals, Concepts, Applications" by Reissland, M.U, New Age International (P) Limited, 2006.
3. A Course on "Electrical and Electronic Measurements & Instrumentation" by J.B.Gupta, Fourteenth Edition, S.K.Kataria& Sons publisher of Engineering and Computer Books,July 10,2014.
4. Electronic Instrumentation and Measurements 4th Edition by H S Kalsi, TMH 2019.

CONTROL SYSTEMS

Subject Code: UGEE5T0322	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Mathematics

Course Objectives:

- To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function
- To analyze the time response of first and second order systems and improvement of performance using PI, PD, PID controllers. To investigate the stability of closed loop systems using Routh's stability criterion and root locus method.
- To understand basic aspects of design and compensation of LTI systems using Bode diagrams.
- To learn Frequency Response approaches for the analysis of LTI systems using Bode plots, polar plots and Nyquist stability criterion.
- To learn state space approach for analysis of LTI systems and understand the concepts of controllability and observability.

Syllabus

UNIT –I	**Mathematical Modelling of Control Systems**	**Hours: 09**

Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems - transfer function of Armature voltage-controlled DC servo motor - block diagram algebra - signal flow graph – reduction using Mason's gain formula.

UNIT –II	**Time Response Analysis and Stability**	**Hours: 09**

Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) - proportional integral derivative (PID) systems.

Stability Assessment Techniques

The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept– construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function.

UNIT –III	**Frequency Response Analysis**	**Hours: 08**

Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin).

UNIT –IV	Classical Control Design Techniques	Hours: 09
Lag, lead, lag-lead compensators - physical realization - design of compensators using Bode plots		
UNIT- V	**State Space Analysis of Linear Time Invariant**	**Hours: 08**
Concepts of state - state variables and state model - state space representation of transfer function - diagonalization using linear transformation - solving the time invariant state equations - State Transition Matrix and its properties- concepts of controllability and observability.		

Course Outcomes: At the end of this course, students will be able to
CO1: Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs
CO2: Determine time response specifications of second order systems and absolute and relativestability of LTI systems using Routh's stability criterion and root locus method
CO3: Analyze the stability of LTI systems using frequency response methods
CO4: Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode diagrams
CO5: Represent physical systems as state models and determine the response. Understand the concepts of controllability and observability.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	3

Textbooks:

1. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall ofIndia
2. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

Reference Books:

1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th Edition.
2. Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition
3. Control Systems by Manik Dhanesh N, Cengage publications.

EMPLOYABILITY SKILLS
(English, Aptitude and Logical Reasoning)
(Common to All Branches**)**

Subject Code: UGBS5T0122	**L**	**T**	**P**	**C**
III Year/ I Semester	**2**	**0**	**2**	**3**

PRE-REQUISITE : Basic competency in understanding passages and the use of grammar & words correctly

COURSEOBJECTIVES:

- To expose students to enhance their verbal ability and inter personal skills
- To prepare students to acquire skills in aptitude for careers prospects
- To prepare students to develop logical reasoning for employment

SYLLABUS

UNIT I: (9 Hours)

High frequency words: Selected 101 words with their ***basic*** meaning, commonly used synonyms and 101 words usage in sentences

UNIT II: (9Hours)

Reading Comprehension passages: Tactics in understanding the given Comprehension passages & Practice tests

UNIT III: (9 Hours)

Interpersonal Skills: Verbal & Non-verbal Communication &Team Work

Percentages -Percentage-Conversion of fraction to percentage and Percentage to Fraction-percentage excess & shortness, Effect of percentage change on a Number-Effect of two step change-Effect of percentage change on product.

UNIT IV: (9 Hours)

Time & Work: Rate of work-Work as a single unit-No.of persons working together–No. of man days.

Time & Distance: Speed –Average Speed –problems on trains–Relative speed –Boats and streams

UNITV: (9 Hours)

Coding, Decoding, Letter and Number Series: Letter Coding, Direct Lettercoding, Number / Symbol coding, Substitution Coding, Deciphering message word coding and its types, Number

series, Letter Series.

Data Analysis and Interpretation: Tabulation- Pie Charts – Bar Diagrams – LineGraphs.

COURSEOUTCOMES:

Up on the completion of the course, students will be able to:

CO1: Make effective use of words inreceptive as well as productive communication (L3)

CO2: Examine the Reading comprehension passages to understand and later, answer thequestions correctly (L2)

CO3: Develop team work and interpersonal skills with groups as well as the skill of calculating percentages (L3)

CO4: Apply the knowledge of math in distance, time related concepts (L3)

CO5: Develop proficiency in numerical reasoning.(L3)

MappingofCOstoPOs:

POs	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	-	3

TextBooks:

1. Objective English –Hari Mohan Prasad & UmaRani
2. Professional Communication–Globarena–IEGpublications
3. A Modern Approach to Verbal and Non-verbal Reasoning by Dr.R.S.Aggarwal
4. Quantitative aptitude and Reasoning by R V Praveen(3rd edition)

Reference:

1. High frequency 101 wordlist: https://crunchprep.com/gre/101-high-frequency-gre-words
2. Quantitative Aptitude by Abhijit Guha –TMH Publishers

FOUNDATIONS IN COMPUTER SCIENCE
(Professional Elective-I)

Subject Code: UGEE5T0422	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Course objectives: This course is designed to:

1. Explain the concepts of computers and classify based on type and generation.
3. Teach about the purpose of networks and types of networks and media to connect the computers
4. Teach about Operating Systems and its concepts.
5. Illustrate about database architecture and its components
6. Illustrate about distributed computing, peer to peer, grid, cloud on demand and utility computing.

UNIT I: **8 hours**

A Simple Computer System: Central processing unit, the further need of secondary storage, Types of memory, Hardware, Software and people.

Peripheral Devices: Input, Output and storage, Data Preparation, Factors affecting input, Input devices, Output devices, Secondary devices, Communication between the CPU and Input/ Output devices. (Text Book 1)

UNIT II: **9 hours**

Computer Networks: Introduction to computer Networks, Network topologies-Bus topology, star topology, Ring topology, Mesh topology, Hybrid topology, Types of Networks: Local area Network, Wide Area Networks, Metropolitan Networks, Campus/ Corporate Area Network, Personal Area Network, Network Devices- Hub, Repeater, Switch, Bridge, Router, Gateway, Network interface Card, Open System Inter Connection Model (Text Book 2)

UNIT III: **8 hours**

Operating systems: Introduction, Evolution of operating systems, Process Management- Process control block, Process operations, Process scheduling, Command Interpreter, Popular operating systems- Microsoft DOS, Microsoft Windows, UNIX and Linux. (Text Book 2)

UNIT IV: **9 hours**

Database Systems: File-Oriented Approach, Database-oriented Approach-Components of Database system, Advantages & Disadvantages of Database approach, Applications of Database systems, Database views, Three-schema architecture, Database models-Hierarchical model, Network Model, relational Model, Object-oriented Data Model, Components of database management systems, Retrieving Data through Queries (Text Book 2)

UNIT V: **8 hours**

Emerging Computer Technologies: Distributed Networking, Peer-to-peer Computing, Grid Computing-components of Grid computing, Applications of Grid computing,Cloud Computing-characteristics of cloud computing systems, cloud computing services, cloud computing architecture, cloud computing applications, Cloud computing concerns (Text Book 2)

COURSE OUTCOMES: On completion of the course the student will be able to

CO1: Explain the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.

CO2: Recognize the Computer networks, types of networks and topologies.

CO3: Summarize the concepts of Operating Systems and Databases.

CO4: Recite the Advanced Computer Technologies like Distributed Computing & Cloud computing

Mapping of COs to POs:

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

TEXT BOOKS:

1. An Introduction to Computer studies –Noel Kalicharan-Cambridge

2. Fundamentals of Computers –ReemaThareja-Oxford higher education

REFERENCES:

1. Introduction to Information Technology – ITL education Solution Limited, Pearson

2. Computer Science and overview-J. Glenn Brookshear, Dennis Brylow-Pearson

SPECIAL ELECTRICAL MACHINES
(Professional Elective-I)

Subject Code: UGEE5T0522	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Electrical Machines

Course Objective: To understand the construction details, working principle and operationof special machines.

Syllabus

UNIT –I STEPPER MOTORS **Hours: 10**

Construction – Principle of operation – Theory of torque production – Hybrid stepping motor – Variable reluctance stepping motor – Open loop and closed loop control.

UNIT –II SWITCHED RELUCTANCE MOTOR **Hours: 10**

Principle of operation – Design of stator and rotor pole arc – Power converter for switched reluctance motor – Control of switched reluctance motor.

UNIT –III PERMANENT MAGNET BRUSHLESS DC MOTOR **Hours: 10**

Construction – Principle of operation – Theory of brushless DC motor as variable speed synchronous motor – Sensorless and sensor based control of BLDC motors.

UNIT – IV PERMANENT MAGNET SYNCHRONOUS MOTOR **Hours: 10**

Principles of operation–Constructional features– Phasor diagram – EMF and Torque equations– Torque/Speed characteristics – Power controllers–applications.

UNIT –V LINEAR MOTORS& OTHER SPECIAL MACHINES **Hours: 8**

Linear induction motor: Construction– principle of operation– applications. Linear synchronous motor: Construction– principle of operation– applications.

Constructional features – Principle of operation and Characteristics of Hysteresis motor– Synchronous Reluctance Motor -applications

Course Outcomes: At the end of this course students will be able to

CO1: To explore the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines

CO2: To impart knowledge on constructions, working and performance of steppers motors and switched reluctance motor

CO3: To analyze the performance of PMBLDC Motor and PMSM

CO4: To understand the Linear motor and other special machines

CO-PO MAPPING:

PO's	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3		3										
CO2	3	3												
CO3	3	3	3											
CO4	3	3		3										

TextBooks:

1. "Special Electrical Machines", K. Venkata Ratnam, University press, New Delhi, 5th Edition, 2016
2. "Special Electrical Machines", E.G. Janardanan, PHI, 1st Edition, 2014

ReferenceBooks:

1. "Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design and Applications", R. Krishnan, CRC Press, 1st Edition, 2001
2. "Permanent Magnet and Brushless DC Motors", T. Kenjo and S. Nagamori, Oxford University press, Oxford, UK, 1988

SIGNALS AND SYSTEMS
(Professional Elective-I)

Subject Code: UGEE5T0622	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**-**	**-**	**3**

Prerequisites: Transform calculus & complex variables

Course Objective: To introduce about signals and systems, Fourier series and transform, sampling theorem, linear systems, Laplace transform and Z transform.

Syllabus

UNIT –I	**INTRODUCTION**	**Hours: 08**
Definition of Signals and Systems, Basic signals, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling Classification of Signals, Problems on classification and characteristics of Signals.		
UNIT –II	**FOURIER SERIES**	**Hours: 10**
Orthogonality in signals, approximation of signals,Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum.		
UNIT –III	**ANALYSIS OF LINEAR SYSTEMS**	**Hours: 08**
Classification of Systems, Response of a system, Filter characteristics of linear systems and characteristics of low-pass, band-pass and band-stop, Concept of convolution		
UNIT – IV	**FOURIER TRANSFORMS ANDSAMPLING**	**Hours: 08**
Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms. Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing,		
UNIT –V	**Transform Techniques**	**Hours: 10**
Laplace Transforms Introduction to Laplace transforms, Relation between L. T's, and F.T. of a signal, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L. T's, inverse Laplace transforms. Laplace transform of certain signals using waveform synthesis. **Z- Transforms** Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, properties of Z-transforms and Inverse Z-transform. Solving difference-equations.		

Course Outcomes: At the end of this course students will be able to
CO1: Explain the fundamental characteristics of signals and systems.
CO2: Recall the concepts of Fourier series and Fourier transform and apply the same for different continuous time signals and systems
CO3: Interpret the practical relevance of sampling process and explain the effects of under sampling**.**
CO4: Analyze different systems and examine its response
CO5: Apply the relevant transform techniques for the analysis of continuous and discrete time systems

CO – PO Mapping

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO**	**PSO**
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

TextBooks:

1. "Signals, Systems & Communications", B.P. Lathi,, BS Publications, 2003.
2. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn
3. "Signals& Systems", Narayan Iyer and K Satya Prasad, Cenage Pub.
circuits" by C. K. Alexander and M. N. O. Sadiku, 5th edition, McGraw hill Publishers, 2013

ReferenceBooks:

1. "Signals & Systems", Simon Haykin and Van Veen, Wiley, 2nd Edition
2. "Principles of Linear Systems and Signals", BP Lathi, Oxford University Press, 2015
3. "Signals and Systems", K Raja Rajeswari, B VisweswaraRao, PHI, 2009

Utilization of Electrical Energy
(Professional Elective-I)

Subject code: UGEE5T0722	**L**	**T**	**P**	**C**
III YEAR -I SEM	**3**	**-**	**-**	**3**

Pre requisite: Fundamentals of circuits and electrical machine, lighting Principles.

Objective: Preamble:

This course primarily deals with utilization of electrical energy generated from various sources. It is important to understand the technical reasons behind selection of motors for electric drives based on the characteristics of loads. Electric heating, welding an illumination are some important loads in the industry in addition to motor/drives. Another major share of loads is taken by Electric Traction. Utilization of electrical energy in all th above loads is discussed in detail in this course. Demand side management concepts are als introduced as a part of this course.

UNIT –I	**Selection of Motors**	**Hours: 10**
Choice of motor, type of electric drives, starting and running characteristics–Speed control–Temperature rise–Applications of electric drives–Types of industrial loads–continuous–Intermittent and variable loads–Load equalization.		
UNIT –II	**Electric Heating and Welding**	**Hours: 09**
Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating – Arc furnaces – Direct and indirect arc furnaces **Electric Welding** Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding		
UNIT –III	**Illumination fundamentals**	**Hours: 10**
Introduction, terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Discharge lamps, MV and SV lamps, Types and design of lighting and flood lighting–LED lighting, principle of operation, street lighting and domestic lighting.		
UNIT –IV	**Electric Traction – I**	**Hours: 07**
System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed– time curves for different services – Trapezoidal and quadrilateral speed time curves-High speed transportation trains.		
UNIT –V	**Electric Traction – II**	**Hours: 07**
Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking, retardation adhesive weight and coefficient of adhesion–Principles of energy efficient motors-Modern traction motors.		

Course Outcomes:

CO1: To able to choose the selection of motors for suitable application.
CO2: To acquaint with the different types of heating and welding techniques.
CO3: To study the basic principles of illumination and analyze the different types of lightning system including design
CO4: To acquire the basic principle of electric traction including speed–time curves of different traction services and to analyze the various traction systems for braking, acceleration and other related parameters

CO-PO mapping:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												

Text Books:
1. "Utilization of Electric Energy" – by E. Openshaw Taylor, Orient Longman.
2. "Art & Science of Utilization of electrical Energy" – by Partab, DhanpatRai&Sons.
Reference Books:
1. "Utilization of Electrical Power including Electric drives and Electric traction" – byN.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. "Generation, Distribution and Utilization of electrical Energy" – by C.L. Wadhwa,New Age International (P) Limited, Publishers, 1997.

DIGITAL LOGIC DESIGN THROUGH VERILOG
(Professional Elective-I)

Subject Code: UGEE5T0822	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Electronics Devices and Circuits, Digital Logic Design.

Course Objective: The objective of this course is to to get familiarized with Digital Logic families and to use computer-aided design tool (Verilog HDL) for development of complex digital logic circuits. And design a prototype with the standard cell technology and programmable logic.

Syllabus

UNIT –I LOGIC FAMILIES **Hours: 10**

Bipolar Logic Families: RTL, DTL, I2L, Transistor Inverter, Basic TTL, Schottky TTL, TTL Families, Emitter coupled logic, ECL Families,

CMOS Logic Families: Introduction to logic families, CMOS logic, CMOS electrical properties, Steady state and dynamic electrical behaviour of CMOS circuit, CMOS logic families, Tristate CMOS buffer, CMOS/TTL interfacing.

UNIT –II INTRODUCTION TO HDL (VERILOG) AND MODELINGS **Hours: 12**

Introduction to HDL (Verilog): Levels of Design Description, Module, Test Bench, Compiler Directives, Simulation and Synthesis Tools, Language Constructs and conventions.

Types of Modeling: Switch Level Modeling, Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vectors, Operators Illustration of above modeling examples.

UNIT –III GATE LEVEL MODELING AND BEHAVIORAL MODELING **Hours: 24**

Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Delays, Strengths and Construction Resolution, Net Types.

Behavioral Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Assignments with Delays, wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non- Blocking Assignments, case statement, if, Assign, Repeat, for loop, While loop, Illustrative Examples

UNIT –IV COMBINATIONAL CIRCUIT DESIGN USING VERILOG HDL **Hours: 10**

Parallel Adder cum Subtractors circuit, Carry looks ahead Adder, Decoders, Encoders, Multiplexers, Demultiplexers, comparators, code converters, Priority Encoder, Dual Priority Encoder, Floating Point encoder, Barrel shifter, one-b it counter. Parity circuits, Verilog HDL program for the above combinational logic circuits with relevant ICs

UNIT –V SEQUENTIAL LOGIC CIRCUIT DESIGN USING VERILOG HDL Hours: 10

Sequential logic circuit design using Verilog HDL: SSI latches and Flip-flops, Counters, Design of Counters using Digital ICs, Ring Counter, Johnson counter, Modulus N Synchronous counters, MSI Registers, Shift Registers, Modes of operation of shift registers, Universal Shift registers. Verilog HDL program for the sequential logic circuits with relevant ICs.

Course Outcomes: At the end of this course students will be able to

CO1: Illustrate characteristics of Bipolar and CMOS logic families.

CO2: Demonstrate different design constraints in Verilog HDL

CO3: Categorize different modeling styles

CO4: Design combinational circuits using digital ICs in Verilog HDL

CO5: Design sequential circuits using digital ICs in Verilog HDL

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													
CO2	3		3		3									
CO3	3				3									
CO4	3		3											
CO5	3		3											

TextBooks:

1.T1. John F. Wakerly, "Digital Design Principles & Practices", PHI Education, 3rd Ed., 2005.

2.T2. Zainalabdien Navabi, "Verilog Digital System Design", TMH, 2nd Edition.

REFERENCE BOOKS:

1.R1. Samir Palnitkar, "Verilog HDL" Pearson Education, 2nd Edition, 2009.

2.R2. J. Bhasker, "A Verilog HDL Primer", Star Galaxy Publishing, 3rd Edition

POWER ELECTRONICS AND DRIVES LAB

Subject Code:UGEE5P0922	**L**	**T**	**P**	**C**
III Year/I Semester	**0**	**0**	**3**	**1.5**

Course Objectives : To train students on the analysis of the power semiconductors devices, power electronic converters and Drives.

Syllabus

EXPERIMENTS:

1. Gate firing circuits for SCR's
2. Single-Phase Half controlled converter with R and RL load
3. Single-Phase fully controlled bridge converter with R and RL loads
4. Single-Phase AC Voltage Controller with R and RL Loads
5. Single-Phase dual converter with RL loads
6. Three-Phase full converter with RL–load.
7. Single-Phase PWM inverter.
8. Single-Phase diode bridge rectifier with R load and capacitance filter.
9. Single-Phase Inverter fed Induction Machine Drive.
10. Arduino code-based Gate pulse generation for Single Phase Bridge Rectifier.

Additional Experiments:

1. Four Quadrant chopper fed DC Drive.
2. DC–DC Buck converter and Boost converter.
3. DC–DC Buck – Boost converter.
4. Arduino code-based Gate pulse generation for Three Phase Inverter.

Course Outcomes: At the end of this course students will be able to,
CO1: Analyze the operation of firing circuits for SCR
CO2: Classify and analyze control of different power electronic converters
CO3: Analyze the operation of power electronic converter fed drives
CO4: Analyze the program/Code to generate the gating pulses for converters

Mapping of Cos to POs:

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3			2										3
CO2	3			3										3
CO3	3			3										3
CO4	3		3	2	2									3

ELECTRICAL MEASUREMENTS & INSTRUMENTATION LAB

Subject Code: UGEE5P1022	**L**	**T**	**P**	**C**
III Year / I Semester	**0**	**0**	**3**	**1.5**

List of Experiments

Any 10 of the following experiments are to be conducted

1. Calibration and Testing of Single-phase Energy Meter.
2. Crompton D.C. Potentiometer – Calibration of PMMC Ammeter and PMMC Voltmeter.
3. Kelvin's Double Bridge – Measurement of Resistance – Determination of Tolerance.
4. Capacitance Measurement using Schering Bridge.
5. Inductance Measurement using Anderson Bridge.
6. Measurement of 3-phase Reactive Power with single–phase wattmeter for balanced loading.
7. Calibration of LPF wattmeter – by Direct loading.
8. Parameters of Choke coil.
9. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given C.T. by Null method.
10. Measurement of Power by 3 Voltmeter and 3 Ammeter methods.
11. Measurement of 3-Φ power with single wattmeter and 2 No's of C.T.
12. Measurement of phase difference, frequency using Lissajous patterns in CRO.
13. LVDT characteristics and calibration
14. Study of Angular measurement using Resistive Trainer
15. Measurement of current using Hall effect transducer.
16. Microcontroller based Load cell calibration and Measurement of weight.
17. Measurement of Light Intensity using Photo Resistor.

Course Outcomes: At the end of this course students will be able to

CO1: Calibrate single phase energy meter, PMMC voltmeter and Ammeter, LPF wattmeter and Load Cell Sensor.

CO2: Measure the electrical parameters - voltage, current, power, energy, frequency and phase difference using various meters.

CO3: Determine resistance, inductance and capacitance through various bridges.

CO4: Measure the Non-Electrical quantities - light intensity and displacement.

CO-PO MAPPING:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												

Digital Systems Design and Advanced Control Systems Lab
(Skill oriented Course)

Subject Code: UGEE5K1122	**L**	**T**	**P**	**C**
III Year / I Semester	**1**	**-**	**2**	**2**

List of Experiments
PART-A
Digital Systems Design

Any 5 experiments

1. Develop a Verilog code for a half adder and full adder circuits and verify their functionality using any design tools.
2. Develop a Verilog code for a half subtractor and full subtractor circuits and verify their functionality using any design tools.
3. Develop Verilog code for the following converters and verify their functionality using any design tools.
   (i) 4-bit Grey to Binary code converter
   (ii) Binary to Gray Converter
4. Develop a Verilog code for the following multiplexer and verify their functionality using any design tools.
   (i) 2 X1 Multiplexer
   (ii) 4 X1 Multiplexer
5. Develop a Verilog code for a D/T flip flop using J-K flip flop and verify using any design tools.
6. Develop a Verilog code for a decoder and verify using any design tools.
7. Develop a Verilog code for a priority encoder and verify using any design tools.

PART-B
Advanced Control systems

Any 5 experiments

1. Conduct an experiment on a Temperature Control Lab (TCLab) to develop its energy balance model and validate the same through simulations.

2. Conduct an experiment on a Temperature Control Lab (TCLab) to develop a data-driven model and compute the FOPDT model parameters by graphical method

3. Conduct an experiment on a Temperature Control Lab (TCLab) to develop a data-driven model and compute the FOPDT model parameters by optimization method

4. Conduct an experiment on a Temperature Control Lab (TCLab) to quantify the offset between the setpoint (desired target) and the measured temperature when using a proportional-only controller

5. Implement a PI controller on a Temperature Control Lab (TCLab) and show the control performance with a setpoint change from 23^0C to 60^0C

6. Conduct an experiment on a DC Motor control system to develop a data-driven model and compute the FOPDT model parameters by graphical method

7. Implement a PI controller on a DC Motor control system and show the control performance for a desired set-speed.

Course Outcomes (PART-A): At the end of this course students will be able to

CO1 Develop and validate digital circuits using hardware description languages (HDL) with proficiency.

CO2 Understand and implement core digital components, including arithmetic units, multiplexers, and memory elements.

CO3 Employ simulation tools effectively to verify the functionality and correctness of digital designs.

CO4 Grasp foundational concepts in digital design, from basic gates to complex modules, and their applications in real-world scenarios.

CO-PO MAPPING (PART-A):

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

Course Outcomes (PART-B): At the end of this course students will be able to

CO1 Develop and validate control models for real-world systems, emphasizing temperature control labs and DC motors.

CO2 Implement and assess control strategies, including proportional and PI controllers, for system performance optimization.

CO3 Utilize graphical and optimization methods to derive First Order Plus Dead Time (FOPDT) model parameters.

CO4 Analyze control systems' behavior under varying conditions and setpoints to ensure robust and stable performance.

CO-PO MAPPING (PART-B):

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

INTELLECTUAL PROPERTY RIGHTS & PATENTS
(Common to all branches)

Subject Code: UGMB5A0122	**L**	**T**	**P**	**C**
III Year / I Semester	**2**	**0**	**0**	**0**

Course Objectives: This course introduces about intellectual property laws, trademarks, copyrights and patents.

Syllabus:

UNIT-I: (6 Hours)
Intellectual Property Law: Basics, Types,Agencies Responsible for IP Registration, International Organizations, Agencies and Treaties, Importance of IPR.
Trademark Law: Purpose of Trademarks, Types,Acquisition,Common Law Rights, Lawsand Treaties Governing Trademarks,Categories,Trade Names and Business Names, Protectable Matter, Exclusions from Trademark Protection, Selecting and Evaluating a Mark, Trademark Search.

UNIT-II: (5 Hours)
Copyright Law: Common Law Rights, Originality of Material, Fixation of Material, Works of Authorship, Exclusions, Compilations, Collections and Derivative Works.
Rights Afforded by Copyright Law: Rights of Reproduction, Derivative Works, Distribution and the First Sale Doctrine, Work Publicly, Rights to Display the Work Publicly, Other Limitations on Exclusive Rights, Moral Rights and the Visual Artists Rights, Compulsory Licenses.

UNIT-III: (7 Hours)
Copyright Ownership and Transfers: Ownership Issues, Joint Works, Ownership in Derivative or Collective Works, Works Made for Hire, Transfers, Termination of Transfers andDuration.
Copyright Infringement: Elements, Contributory and Vicarious Infringement, Defences to Infringement, Infringement Actions.
New Developments: Protection for Computer Programs and Automated Databases, Copyright in the Electronic Age, Entertainment Notes, Recent Developments, Terms of the Trade, Semiconductor Chip Protection.

UNIT-IV: (6 Hours)
Patent Law: Introduction, Patentability, Design Patents, Plant Patents, Double Patenting.
Patent Searches and Application: Searching, Application Process, Prosecuting the Application, Post-issuance Actions, Term and Maintenance of Patents.
Patent Ownership and Transfer: Ownership Rights, Sole and Joint Inventors, Disputes,Inventions made by Employees and Independent Contractors, Assignment of Rights, Licensing, Invention Developers and Promoters.

UNIT-V: (6 Hours)
Patent Infringement: Direct Infringement, Inducement to Infringe, ContributoryInfringement, First Sale Doctrine, Indirect Infringement, Infringement Abroad, Claims Interpretation,Defences, Remedies,Resolving a Dispute andLitigation.

New Developments: International Patent Protection, Patent Cooperation Treaty, European Patent Organization, Patent Prosecution Highway, Agreement on Trade-Related Aspects of IPR, Patent Law Treaty, Foreign Filing Licenses.

Intellectual Property Audits: Practical Aspects of Intellectual Property Audits, Conducting the Audit, Postaudit Activity.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Understand the intellectual property law.

CO2: Understand the need of trademark and its use.

CO3: Familiar with copyright laws and its rights, ownership, transfers and copyright Infringement.

CO4: Acquire the knowledge on various aspects of patents.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	3	-	-	-	-
CO3	3	3	3	-	-	-	-	3	-	3	-	-
CO4	3	3	3	-	-	3	3	3	-	3	-	-

TEXT BOOKS:

1. Deborah E.Bouchoux, "Intellectual Property", Cengage Learning
2. Asha Vijay, DurafeDhanashree and K. Toradmalle, "Intellectual Property Rights", Wiley India
3.Neeraj Pandey and KhushdeepDharni,"Intellectual Property Rights", PHI Learning, 2014.

REFERENCE BOOKS:

1. Kompal Bansal &Parishit Bansal, "Fundamentals of IPR for Engineers", BS Publications.
2. PrabhuddhaGanguli, "Intellectual Property Rights", Tata Mc-Graw Hill, New Delhi.
3. R.Radha Krishnan, S.Balasubramanian, "Intellectual Property Rights", Excel Books. New Delhi.
4. M.Ashok Kumar and Mohd.Iqbal Ali, "Intellectual Property Right", Serials Pub.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
6. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand.
8. Dr. A. Srinivas, "Intellectual Property Rights (Patents & Cyber Law)", Oxford University Press, New Delhi.

Power system Analysis

Subject Code: UGEE6T0122	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**-**	**-**	**3**

Prerequisites: Electrical circuit analysis, power systems Transmission, numerical techniques

Course Objective: The course is designed to give students the required knowledge for the mechanical design of overhead lines, cables, substations and DC transmission. Calculation of power flow in a power system network using various techniques, formation of Zbus and its importance are covered in this course. It also deals with short circuit analysis and analysis of power system for steady state and transient stability

Syllabus

UNIT – I	**Power System network matrices**	**Hours: 09**
Graph Theory- Bus admittance matrix using Direct inspection method and singular transformation– Bus impedance matrix representation- numerical problems.		
UNIT – II	**Power flow studies**	**Hours: 09**
Necessity of Power Flow Studies, Bus Classification – static load flow equations - load flow analysis using Gauss-Seidel, Newton-Raphson method - numerical problems (Max. 3 buses) – Decoupled and Fast Decoupled method (algorithmic approach) - Comparison of load flow methods		
UNIT – III	**Per unit system and Symmetrical Fault Analysis**	**Hours: 08**
single line diagram of power system components – per unit quantities – reactance diagram – Classification of Faults in a power system - short circuit analysis – Short circuit capacity - numerical problems.		
UNIT – IV	**Symmetrical Components & Unsymmetrical Fault Analysis**	**Hours: 08**
symmetrical components - Transformation matrices used in resolution of unbalanced voltages and currents- Positive, Negative and Zero sequence networks of power system components like synchronous machines, transformers, transmission lines – numerical problems **Unsymmetrical fault analysis** - LG, LL, LLG and open circuit faults – analysis through sequence components – numerical problems		
UNIT – V	**Power system Stability Analysis**	**Hours: 08**
steady state and transient stability – Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient - Power Angle Curve - swing equation – equal area criterion – Application of Equal Area Criterion - critical clearing angle and clearing time		

Course Outcomes: At the end of this course students will be able to

CO1: develop Y bus matrix for a power system network to apply in load flow studies

CO2: Interpret the power flow studies using Gauss-Seidel, Newton Raphson, decoupled and fast decoupled load flow methods

CO3: apply per unit system in fault analysis and determine the symmetrical fault current and voltages

CO4: Apply symmetrical component theory to determine the unsymmetrical fault current and voltages

CO5: Explain the concepts of power system stability

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3			3									
CO3	3	3												
CO4	3	3												
CO5	3	3												

Text Books:

1. Power System Analysis by Grainger and Stevenson, Tata Mc-Graw Hill.
2. Modern Power system Analysis – by I. J. Nagrath& D. P. Kothari: Tata McGraw–Hill Publishing Company, 2nd edition

Reference Books:

1. "Power System Analysis by Hadi Saadat – TMH Edition.
2. Power System Analysis by B. R. Gupta, Wheeler Publications

POWER SYSTEM PROTECTION

Subject Code: UGEE6T0222	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Fundamentals of electrical circuits and principles of power system.

Course Objective:

In order to protect the equipment's and components against various operating conditions and over voltages protective devices are required to be installed in the system. Topics specified in this subject deal with various types of protective equipment's and their working principle including limitations etc.

UNIT–I	**Circuit Breakers:**	**Hours: 10**
Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.- Restriking Phenomenon, Average and Maximum RRRV and Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Autoreclosures. Operation of Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum, and SF6 circuit breakers and Miniature Circuit breaker (MCB).		
UNIT –II	**Electromagnetic Relays:**	**Hours: 10**
Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc and Induction Cup relays. Types of Over Current Relays: Instantaneous, DMT and IDMT types. Application of relays: Over current/ under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation, Distance relays: Impedance, Reactance, and Mho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison.		
UNIT –III	**Protection of Power Equipment & Transmission lines**	**Hours: 09**
Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection. Protection of Lines: Over Current, Carrier Current protection-Translay Relay. Protection of Bus bars – Differential protection.		
UNIT – IV	**Protection Against Over voltage and neutral Grounding**	**Hours: 10**
Generation of Over Voltages in Power Systems.- Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination -BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time Characteristics.		
Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices.		
UNIT –V	**Static and Microprocessor Relays**	**Hours: 09**
Static relays: Static relay components– Static over current relay– Static distance relay– Microprocessor based digital relays. Simple Programs.		

Course Outcomes: At the end of this course students will be able to
CO1: To apply knowledge to principles of circuit breakers and analyze the operation of different type of
CO2: To acquire the concept of the operation and working of principles of different electromagnetic relays
CO3: Acquire in depth knowledge of generator and transformer protection schemes
CO4: To analyze operation of different protection schemes applied to power system equipment and
CO5: To analyze the protection against the over voltages and neutral grounding
CO6: To acquire the concept of static and micro process relays and analyze the protection principles

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3											
CO2	3	3	3											
CO3	3	3	3											
CO4	3	3	3											
CO5	3	3	3											
CO6	3	3	3											

TextBooks:

1. Power System Protection and Switchgear, by Badri Ram, D. N Viswakarma, TMH Publications, 2011
2. Electrical Power Systems by C. L. Wadhwa , New Age international (P) Limited, Publishers, 6th Edition 2007
3. Protection and Switchgear by Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chothani, Oxford publishers

ReferenceBooks:

1. Switchgear and Protection by Sunil S Rao, Khanna Publishers, 2008.
2. Fundamentals of Power System Protection by Paithankar and S.R.Bhide., PHI, 2003.
3. Art & Science of Protective Relaying – by C R Mason, Wiley Eastern Ltd
4. Power System Protection and Switchgear by B.Ravindranath & M.Chander, New Age International Pvt .Ltd.

MICRO PROCESSORS & MICRO CONTROLLERS

Subject Code: UGEE6T0322	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**-**	**-**	**3**

Prerequisites: Digital Electronics

Course Objective: To introduce about digital controller and its features to develop assembly level programs. To provide solid foundation on interfacing the external devices to the processor according to the user requirements.

Syllabus

UNIT –I 8086 MICROPROCESSOR Hours: 10

Introduction and evolution of Microprocessors- 8086 Architecture, pin description, Register organization, Memory organization - General bus operation of 8086- Minimum mode and Maximum mode operation of 8086.

UNIT –II MICROPROCESSOR PROGRAMMING Hours: 10

Instruction formats, addressing modes, instruction set, assembler directives. Macros, Simple programs involving logical, branch and call instructions. Sorting, evaluating arithmetic expressions, string manipulations.

UNIT –III MICROPROCESSOR I/O INTERFACING Hours: 12

8255 PPI– Architecture of 8255–Modes of operation– Interfacing I/O devices to 8086 using 8255– Interfacing A to D converters and D to A converters– Stepper motor interfacing. Memory interfacing to 8086, Interrupts of 8086, Vector interrupt table, Interrupt service routine.

UNIT – IV 8051 MICROCONTROLLER Hours: 10

Overview of 8051 Microcontroller – Architecture– Memory Organization – Register set – I/O ports- addressing modes and instruction set of 8051, simple programs

UNIT –V 8051 REAL TIME CONTROL, I/O & MEMORY INTERFACING Hours: 10

Interrupts – Timers and Counters – Serial Communication.

LCD, Keyboard, External Memory Interface – ADC, DAC Interface – Stepper Motor interfacing and Waveform generation.

Course Outcomes: At the end of this course students will be able to:

CO1: Understand the architecture of microprocessors and micro controller.

CO2: Understand the programming model of microprocessors and micro controllers.

CO3: Interface different external peripheral devices with microprocessors and micro controllers

CO4: Analyze a problem and formulate appropriate computing solution for processor or controller based application

CO5: Develop an assembly language program for specified application

CO-PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													
CO2	3	3	3											
CO3	3	3	3											
CO4	3	3	3											
CO5	3	3	3											

TextBooks

1. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition 2006
2. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition,Cengage learning,2010
3. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition2006.
4. Digital Electronics and Logic Design, Dr. Sanjay Sarma, Katson Books, Fourth Edition, 2016.
5. Microcontrollers and application, Ajay.V. Deshmukh, TMGH,2005

ReferenceBooks:

1. The 8051 microcontrollers, architecture and programming andapplications-K.Uma Rao, AndhePallavi., Pearson, 2009.
2. Micro computer system 8086/8088 family architecture, programming anddesign- By Liu and GA Gibson, PHI, 2nd Ed.

OPTIMIZATION TECHNIQUES

(Professional Elective-II)

Subject Code: UGEE6T0422	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites:

Linear Algebra, calculus and Probability & statistics

Syllabus

UNIT I: **(9Lectures)**

Introduction and Classical Optimization Techniques:

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems

Classical Optimization Techniques:

Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions

UNIT II: Linear Programming **(8 Lectures)**

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm - Duality in Linear Programming – Dual Simplex method.

UNIT III: Transportation Problem **(8 Lectures)**

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel‘s approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem.

UNIT IV: Nonlinear Programming: **(8 Lectures)**

Unconstrained cases - One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method - Univariate method, Powell‘s method and steepest descent method.

Constrained cases - Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

UNIT V: Dynamic Programming: (8 Lectures)

Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

Course Outcomes:

CO1: State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.

CO2: Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.

CO3: Develop a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.

CO4: Solve transportation and assignment problem by using Linear programming Simplex method.

CO5: Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.

CO6: Apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

Mapping of COs to POs:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												
CO6	3	3												

Text Books:

1. —Engineering optimization: Theory and practice‖-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.

2. —Introductory Operations Research‖ by H.S. Kasene& K.D. Kumar, Springer(India), Pvt .LTd.

Reference Books:

1. —Optimization Methods in Operations Research and systems Analysis‖ – by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.

2. Operations Research – by Dr. S.D.Sharma, Kedarnath, Ramnath & Co

3. Operations Research: An Introduction‖ – by H.A.Taha,PHIpvt. Ltd., 6^{th} edition

4. Linear Programming–by G.Hadley.

DIGITAL CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE-II)

Subject Code: UGEE6T0522	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Control Systems

Course Objective: The purpose of the proposed course is to present control theory that is relevant to the analysis and design of computer-controlled systems, with an emphasis on basic concepts and ideas.

Syllabus

UNIT –I	**Introduction and Signal Processing**	**Hours: 08**
Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Signals and processing – Sample and hold devices – Sampling theorem and data reconstruction – Digital to Analog conversion and Analog to Digital Conversion Frequency domain characteristics of zero order hold.		
UNIT –II	**Review of Z-Transforms**	**Hours: 08**
Z-Transform and theorems, finding inverse and method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems		
UNIT –III	**State Space Analysis**	**Hours: 08**
State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations- Concepts of controllability and observability – Tests (without proof).		
UNIT – IV	**Stability Analysis & Design**	**Hours: 08**
Stability Mapping between the S-Plane and the Z-Plane – Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion. **Design** Transient and steady – State response Analysis – Design based on the frequency response method – Bilinear Transformation and Design using frequency response in the w–plane for lag and lead compensators and digital PID controllers		
UNIT –V	**State Feedback Controllers and Observers**	**Hours: 08**
Design of state feedback controller through pole placement – Ackerman's formula, Introduction to state observers-full order observer design.		

Course Outcomes: At the end of this course students will be able to

CO1: Explain the concepts of digital control systems and recall the fundamentals of signal processing

CO2: Recall the concepts of Z-Transformation

CO3: Interpret linear discrete–time systems in state model

CO4: Examine the stability of linear discrete-time systems by the use of Bilinear Transformation and Routh Stability criterion.

CO5: Identify an appropriate controller for the given specifications and apply conventional and modern design methods for their parameter selection

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													3
CO2	3													3
CO3	3													3
CO4	3	3												3
CO5	3	3	3											3
CO6	3													3

Text Books:

1. "Discrete–Time Control systems", K. Ogata, Pearson Education/PHI, 2nd Edition, 2015.

REFERENCE BOOKS:

1. "Digital Control Systems", Kuo, Oxford, 2nd Edition, 2012.
2. "Digital Control and State Variable Methods", M. Gopal, McGraw Higher Ed, 4th Edition, 2012.
3. "Digital Control Systems", V. I. George, P. C. Kurian, Cengage Learning, 1st Edition, 2012.

DIGITAL SIGNAL PROCESSING

(Professional Elective-II)

Subject Code: UGEE6T0622	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Signals & Systems

Course Objective: To Understanding the digital signal processing approach and digital filter design to introduce signals, systems, time and frequency domain concepts and the associated mathematical tools that are fundamental to all DSP techniques, provide a thorough understanding and working knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.

Syllabus

UNIT –I	**SIGNALS AND SYSTEMS**	**Hours: 10**
Classification of signals: continuous and discrete, energy and power; mathematical representation of signals; sampling techniques, Nyquist rate, aliasing effect - Digital signal representation; Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance.		
UNIT –II	**DISCRETE FOURIER TRANSFORMS**	**Hours:**
DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – Decimation - in - time Algorithms(DIT), Decimation - in – frequency(DIF) Algorithms		
UNIT –	**IIR FILTER DESIGN**	**Hours:**
Structures of IIR (Direct Form I &II, Signal flow graph, Transposed Structure, Cascade and parallel forms) – Design of Analog filter(HPF, BPF, LPF) – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (HPF, BPF, BRF).		
UNIT –	**FIR FILTER DESIGN**	**Hours:**
Structures of FIR (Transversal Structure & Linear phase realization) – Linear phase FIR filter – Filter design using windowing techniques (Rectangular, Triangular, Hamming, Hanning, Blackman, Kaiser), Frequency sampling techniques.		
UNIT –V	**INTRODUCTION TO DIGITAL SIGNAL PROCESSORS**	**Hours:**
Introduction to programmable DSPs: Selecting digital signal processor; Multiplier and Multiplier Accumulator (MAC) – Modified bus structures and memory access schemes in DSPs – Multiple access memory – Multiport memory – Pipelining – Special addressing modes.		

Course Outcomes: At the end of this course students will be able to

CO1: Explain the basic concepts of Signals and systems

CO2: Apply the Discrete Fourier transforms tool for sequences of finite length

CO3: Develop IIR filter and FIR filter for the given set of specifications.

CO4: Summarize fundamentals of programmable DSPs and architecture of DSP processors

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	-	3	2									3	3
CO2	3	-	-	3									-	-
CO3	3	-	3	3									-	-
CO4	2	3	-	2									3	3

TextBooks:

1. "Digital Signal Processing: Principles, Algorithms, and Applications", Proakis J. G., and Manolakis D. G,Prentice-Hall, 4thEdition, 2007.
2. "Digital Signal Processing", Ramesh Babu P, SciTech Publications (India) Pvt. Ltd., New Delhi, 4th Edition, 2010.

ReferenceBooks:

1. "Discrete – Time Signal Processing," Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, Prentice Hall, New Delhi, 3rd Edition, 2009.
2. "Digital Signal Processing – A Computer Based Approach", Mitra S.K., Tata McGraw - Hill Education India Private Limited, New Delhi, 4th Edition, 2011.
3. "The Scientist and Engineer's Guide to Digital Signal Processing", Steven W. Smith, California Technical Publishing San Diego, California, 2nd Edition, 2002.
4. "Digital Signal Processors, Architecture, Programming and Applications," Venkataramani B., Bhaskar M, Tata McGraw- Hill Education India Private Limited, New Delhi, 1st Edition, 2002.
5. "Digital Signal Processing", Emmanuel C. Ifeachor, Barrie.W.Jervis, Pearson Education, 2ndEdition, 2002.

ADVANCED POWER ELECTRONICS
(Professional Elective-II)

Subject Code: UGEE6T0722	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**-**	**-**	**3**

Course Objective :
This course introduces the topologies, operation and control strategies of advanced power electronic converters.

Syllabus

UNIT –I	**Voltage Control of Single Phase Inverter**	**Hours: 08**
PWM – Single Pulse Width Modulation – Multiple Pulse Width Modulation – Sinusoidal Pulse Width Modulation – Modified Sinusoidal Pulse Width Modulation – Phase Displacement Control – Advanced Modulation Control Techniques.		
UNIT –II	**Voltage Control of Three Phase Inverter**	**Hours: 06**
Sinusoidal PWM – 60 Deg PWM – Third Harmonic PWM – Space Vector Modulation – Comparison of PWM techniques – Current Source Inverter – Variable DC link inverter.		
UNIT-III	**Multilevel inverter**	**Hours: 06**
Diode Clamped Multilevel Inverter – Principle of operation – Features – Improved Diode Clamped Multilevel Inverter. Flying Capacitor Multilevel Inverter - Principle of operation – Features. Cascaded Multilevel Inverter - Principle of operation – Features.		
UNIT –IV	**Power Factor Improvement**	**Hours: 08**
Extinction Angle Control – Symmetrical Angle Control – PWM control – Single Phase Sinusoidal PWM – Three Phase PWM Rectifier.		
UNIT –V	**DC Power Supplies**	**Hours: 10**
Switched Mode DC Power Supplies – Flyback Converter – Forward Converter – Push-Pull Converter – Half Bridge Converter – Full Bridge Converter – Resonant DC Power Supplies – Bi-directional Power Supplies.		

Course Outcomes: At the end of this course students will be able to

CO1: Acquire the knowledge about different types of Single and Three phase PWM modulation strategies.

CO2: Design simulated models for the analysis of different topologies of multilevel inverter.

CO3: Understand the basics in PF improvement.

CO4: Acquire the knowledge about different types DC power supply converters.

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		2											3
CO2	3		2											3
CO3	3		2											3
CO4	3		2											3

Text Books:

1. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint- 2008.
2. Power Electronics- Ned Mohan, Tore M.Undelan and William P.Robbins –John Wiley& Sons -2nd Edition.Power Electronics – Lander –Ed.2009.

Reference Books:

1.Modern power Electronics and AC Drives – B.K.Bose.

VLSI DESIGN

(Professional Elective-II)

Subject Code: UGEE6T0822	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Digital Electronics

Course Objective: To learn the different steps involved in the fabrication of ICs using MOS transistor, CMOS/BICMOS transistors, passive components and its electrical properties,design rules to be followed to draw the layout of any logic circuit and different types of logic gates using CMOS inverter and analyze their transfer characteristics, design building blocks of data path of any system using gates, understand basic programmable logic devices and testing of CMOS circuits.

Syllabus

UNIT –I	**INTRODUCTION**	**Hours: 10**
Introduction to IC Technology – MOS, PMOS, NMOS, CMOS &BiCMOS **Basic Electrical Properties:** Basic Electrical Properties of MOS and BiCMOS Circuits: $I_{ds}V_{ds}$ relationships, MOS transistor threshold Voltage, g_m, g_{ds}, Figure of merit ωo;Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.		
UNIT –II	**VLSI CIRCUIT DESIGN PROCESSES**	**Hours: 10**
VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.		
UNIT –III	**GATE LEVEL DESIGN**	**Hours: 15**
Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out, Choice of layers.		
UNIT – IV	**DATA PATH SUBSYSTEMS**	**Hours:10**
Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters. **Array Subsystems:** SRAM, DRAM, ROM, Serial Access Memories.		
UNIT –V	**PROGRAMMABLE LOGIC DEVICES**	**Hours: 10**
PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.		

Course Outcomes: At the end of this course students will be able to

CO1: Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors

CO2: Choose an appropriate inverter depending on specifications required for a circuit

CO3: Design different types of logic gates using CMOS inverter and analyze their transfer characteristics and building blocks of data path using gates

CO4: Design simple memories using MOS transistors and can understand design of large memories

CO5: Design simple logic circuit using PLA, PAL, FPGA and CPLD

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												
CO6	3	3												

TextBooks:

1.Essentials of VLSI circuits and systems – Kamran Eshraghian, EshraghianDougles and A. Pucknell, PHI, 2005 Edition

2.CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee,

ReferenceBooks:

1.CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.

2.Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

Introduction to Machine Learning
(Job Oriented Elective-II)

Subject Code: UGEE6T0922	**L**	**T**	**P**	**C**
III Year / II Semester	**2**	**-**	**2**	**3**

Prerequisites:
Linear Algebra, calculus and Probability & statistics

Syllabus:

UNIT I: Introduction: (9Lectures)
What is machine learning? –Data, models and ML tasks- Forms of learning- supervised, unsupervised and reinforcement learning- Applications Types of data – Data visualization – Data transformation – Feature selection- Feature extraction.

UNIT II: Supervised Learning-I (8 Lectures)
Review of linear algebra- Linear regression, Linear regression with least squares gradient descent- Ridge & Lasso regression- Metrics for assessing regression

UNIT III: Supervised Learning-II (8 Lectures)
Review of probability- Naïve Bayes classifier- KNN classifier- Logistic regression (Binary classification)- Support vector machines (Hard margin)- Metrics for assessing classification.

UNIT IV: Decision Trees (8 Lectures)
Basics of decision tress- Measures of impurity for evaluating splits- Information gain/entropy reduction- Gain ratio- Gini Index- ID3, C4.5 and CART decision trees

UNIT V: Unsupervised Learning & Neural Networks (8 Lectures)
Basics of clustering: Similarity/Dissimilarity Measures, Clustering Criteria. K-Means Algorithm- Hierarchical clustering- K medoids and DBSCAN
Introduction to neural networks-Biological and artificial neuron-Types of activation functions-Architectures of neural networks-Learning process in ANN- Back propagation

At the end of the Course the student shall be able to

CO1: Understand the Basics of Learning methods in Machine learning.

CO2: Use the available regression models and develop a regression model

CO3: Construct models for Classification.

CO4: explore various approaches under unsupervised learning paradigm

CO5: Build decision tress for classification tasks

CO6: Understand the basics of neural networks

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-	-	-

TEXT BOOKS:

1. M. Gopal, Applied Machine Learning 2nd Edition, 2021, Published: August 25, 2021.
2. Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, "Machine Learning", Pearson Education India ,1st edition
3. Tom M. Mitchell, Machine Learning, McGraw-Hill, 2010

POWER SYSTEMS LAB

Course Code: UGEE6P1022	**L**	**T**	**P**	**C**
III Year / II Semester	**-**	**-**	**3**	**1.5**

Course Objectives: To study and analyze different power system protective equipment and renewable energy sources by conducting suitable experiments.

List of Experiments

Any 10 of the following:

1. Experimental simulation ofof Electrical Power transmission line model
2. Experimental simulation of fault analysis on 3 phase Alternator
3. Testing of CT, PT's and Insulator strings.
4. Characteristics of current and potential transformer
5. Characteristics of IDMT Overcurrent Relay
6. Characteristics of Micro controller based IDMT over/under voltage relay
7. Characteristics of Micro controller based single phase differential relay
8. Determination the sequence impedances of 3-Φ Transformer
9. Experimental study of wind profile and wind power characteristics
10. Determination of characteristics of Solar Photovoltaic (PV) module/cell
11. MPPT tracking in PV System
12. Determination of sequence impedances of a cylindrical rotor Synchronous Machine.
13. Determination of Sub-transient reactance's of a Salient Pole Synchronous Machine.

Course Outcomes: At the end of this course students will be able to
CO1: analyze characteristics of wind turbine PV systems, and switchgear equipment.
CO2: determine sequence impedance and Sub-transient reactance of synchronous machine and
CO3: analyze electric power transmission line model

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3						3	3				
CO2	3	3	3						3	3				
CO3	3	3	3						3	3				

CONTROL SYSTEMS LAB

Subject Code: UGEE6P1122	**L**	**T**	**P**	**C**
III Year / II Semester	**-**	**-**	**3**	**1.5**

Course Objective: To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, and A.C. Servo motors and to understand time and frequency responses of control system with and without controllers and compensators.

Syllabus
List of Experiments

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions
4. Effect of feedback on DC servo motor
5. Effect of P, PD, PI, PID Controller on a second order systems
6. Lag and lead compensation – Magnitude and phase plot
7. Transfer function of DC motor
8. Characteristics of magnetic amplifiers
9. Characteristics of AC servo motor
10. Characteristics of DC servo motor
11. Transfer function of DC generator

Course Outcomes: At the end of this course students will be able to
CO1:examine the characteristics of various control system components
CO2:interpret the effects of P, PI, PID controllers
CO3:verify compensator characteristics and logic gates function through PLC
CO4:analyze the response of a second order system

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

MICROPROCESSORS & MICROCONTROLERS LAB

Subject Code: UGEE6P1222	**L**	**T**	**P**	**C**
III Year / II Semester	**0**	**0**	**3**	**1.5**

Course Objective: This course introduces the assembly language programming of 8086 and 8051 microcontrollers. It gives a practical training of interfacing the peripheral devices with the 8086 microprocessor. The course objective is to introduce the basic concepts of microprocessor and to develop in students the assembly language programming skills and real time applications of Microprocessor as well as microcontroller.

List of Experiments

Any 10 of the following experiments are to be conducted

1. Arithmetic operation – Multi byte addition and subtraction, multiplication and division, Signed and unsigned arithmetic operation, ASCII – Arithmetic operation.
2. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
3. By using string operation and Instruction prefix: Move block, Reverse string Sorting, Inserting, Deleting, Length of the string, String comparison.
4. Modular Program: Procedure, Near and Far implementation, Recursion.
5. DOS/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.
6. Interfacing 8255 – PPI
7. Programs using special instructions like swap, bit/byte, set/reset etc.
8. Programs based on short, page, absolute addressing.
9. Interfacing 8259 – Interrupt Controller.
10. Interfacing 8279 – Keyboard Display.
11. Stepper motor control using 8253/8255.
12. Arithmetic and logical operation using 8051 kit.

Course Outcomes: At the end of this course students will be able to

CO1: Develop assembly language programs for various applications using 8086 & 8051 trainer kits

CO2: Illustrate how the different peripherals (8255, 8259 etc.) are interfaced with 8086 Microprocessor.

CO3: Develop the assembly level programming using 8086 instruction set in TASM

CO4: Develop technical writing skills and effective communication.

CO5: Acquire teamwork skills for working in groups.

CO-PO MAPPING:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2			3										
CO2				2										
CO3				2										
CO4										3				
CO5									3					

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
(Common to all branches)

Subject Code: UGBS6A0222	**L**	**T**	**P**	**C**
III Year / II Semester	**2**	**0**	**0**	**0**

Course Objectives:
This course offers an introduction to Indian philosophy, tradition of Indian Science and Mathematics, holistic approach to health and gender sensitization.

Syllabus:

UNIT-I: INDIAN PHILOSOPHY
Origin of Indian philosophy- philosophy of Charvaka, Samkhya, Nyaya, Mimensa, Buddist and Jaina.

UNIT-II: TRADITION OF INDIAN SCIENCE
Historical evolution of medical tradition in ancient India.
Ayurveda: Principles of Ayurvedic Healing -Treating diseases to restore health.
Environmental Knowledge: Nature, flora and fauna, Manusmriti.

UNIT-III: TRADITION OF INDIAN MATHS
Early Historical period, Classical period, Vedic mathematics, Baskaracharya, Lilavati Bijaganitha, Srinivasa Ramanujan - Magic squares.

UNIT-IV: HOLISTIC HEALTH
History, Holistic approach: Enhance living – Mind fullness skills- Spirituality and Healing, Stress Management - Food—Work and Life style.
Yoga –Healthy Body: Introduction to Yoga, - Pranayamam, Surya Namaskara and Personality Development.

UNIT-V: GENDER SENSITIZATION
Basic Gender concepts and terminology, Exploring attitudes towards Gender, Making Women, Making Men, Preparing for Womanhood.
Struggles with discrimination, Gender Roles and Relations, Gender and Human Rights, Types of Gender-based violence, Gender-based violence from a Human Rights perspective, Sexual Harassment, Gender and Media.

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

CO 1. Summarize the essence of Indian philosophy.

CO 2. Outline the tradition of Indian Science and Mathematics.

CO 3. Make use of holistic health practices, spirituality, stress management techniques for healthy life Style and Yoga practices to attain good personality.

CO 4. Develop awareness with regard to issues of gender.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	-	3	-	-	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-	3
CO3	-	-	-	-	-	3	-	-	-	-	-	3
CO4	-	-	-	-	-	3	-	3	-	-	-	-

TEXT BOOKS:

1. "Traditional Knowledge System in India" by Amit Jha, 2009.
2. "Traditional Knowledge System and Technology in India", Basanta Kumar Mohantra, Vipin Kumar Singh, Pratibha Prakashan publisher, 2012.
3. "Towards a World of Equals: A Bilingual Textbook on Gender" written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu and published by Telugu Akademi.
4. "Gender Sensitization" by C. Rajya Lakshmi Kalyani, D.S. Vittal, published by Himalaya Publishing House Pvt. Ltd.

REFERENCES:

1. "Knowledge Traditions and Practices of India", Kapil Kapoor, Michel Danino.
2. S. Radhakrishna, Indian Philosophy, Vol. 1 (London: George Allen and Unwin,1962), 287.
3. J. P. Jain, Religion and Culture of the Jains (Delhi: Bhartiya Jnanpith, 1977) 168
4. D. P. Sen Gupta, Current Science, 78 (12), 1569 (2000)
5. C.N.Srinivasa Iyengar, History of Indian Mathematics, World Press, Calcutta, 1967.
6. G. H Hardy, Ramanujan (Cambridge, 1940).
7. Nutritive Value of Indian Foods, C.Gopalan, B.V.Raman Sastri & S.C. Balasubramanian.
8. George Feuerstein: The Yoga Tradition (Its history, literature, philosophy and practice)
9. Swami Sivananda, Practice of Karma Yoga (The Divine Life Society, Shivananda Nagar, P.O., U.P., Himalayas, India)
10. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
11. IGNOU : Gender Sensitization: Society, Culture and Change (2019) BGSE001, New Delhi IGNOU
12. Jane Pilcher and Imelda Whelehan (2005) : Fifty Key Concepts in Gender Studies

POWER SYSTEM OPERATION AND CONTROL

(Professional Elective-III)

Subject Code: UGEE7T0122	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**-**	**-**	**3**

Prerequisites: Power Systems-I, Control systems

Course Objective: This subject deals with, Economic operation of Power Systems, Hydrothermal scheduling and modeling of turbines, generators and automatic controllers.

Syllabus

UNIT –I	**ECONOMIC OPERATION OF POWER SYSTEMS**	**Hours: 12**
Optimal operation of Generators in Thermal Power Stations- heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected - Optimum generation allocation including the effect of transmission line losses – Loss Coefficients - General transmission line loss formula.		
UNIT –II	**HYDRO-THERMAL SCHEDULING& UNIT Commitment**:	**Hours: 12**
Hydrothermal Scheduling: Optimal scheduling of Hydrothermal System: Hydroelectric power plant models – Scheduling problems – Short term hydrothermal scheduling problem. **Unit Commitment**: Optimal unit commitment problem – Need for unit commitment – Constraints in unit commitment – Cost function formulation.		
UNIT –III	**MODELING OF POWER SYSTEM**	**Hours: 12**
Mathematical Modeling of Speed Governing System – Derivation of small signal transfer function-Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines- Modeling of Excitation System: Fundamental Characteristics of an Excitation system, Transfer function, Block Diagram.		
UNIT – IV	**LOAD FREQUENCY CONTROL**	**Hours: 12**
Necessity of keeping frequency constant - Definitions of Control area – Load frequency control of single-area system – Steady state analysis – Dynamic response – uncontrolled case and controlled case Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias Control, Load Frequency Control and Economic dispatch control.		
UNIT –V	**REACTIVE POWER CONTROL**	**Hours: 12**
Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation –Specifications of load compensator – Uncompensated and compensated transmission lines: Shunt and series compensation		

Course Outcomes: At the end of this course students will be able to
CO1: explain the economic operation of power systems
CO2: interpret the hydrothermal scheduling and unit commitment
CO3: model various power system components
CO4: analyze the operation of Load frequency control of single area and two area power system
CO5: explain the concept of reactive power control

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

TextBooks:

1. "Modern Power System Analysis", I.J. Nagrath and D.P. Kothari, Tata McGraw Hill, 4thEdition, 2011.

2. "Power System Analysis", HadiSaadat, Tata McGraw–hill, 2nd Edition, 2002.

3."Electrical power systems", C.L. Wadhwa, New Age International (P) Limited, Publishers, 6th edition, 2010.

ReferenceBooks:

1."Electric Energy systems Theory", O.I. Elgerd, Tata McGraw–hill, 2nd Edition, 2007.

2."Power System Analysis", Grainger and Stevenson, Tata McGraw Hill, 1st Edition 2003.

3."Power System Analysis and Design", J.Duncan Glover and M.S.Sarma, Thompson, 3rd Edition, 2002.

Power Converter Control strategies
(Professional Elective-III)

Subject Code: UGEE7T0222	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**-**	**-**	**3**

Course Objective:

This course introduces the topologies, operation and control strategies of advanced power electronic converters.

Syllabus

UNIT –I	**Control of DC-DC Converters**	**Hours: 08**
Current control and PWM voltage control techniques for Buck Regulator – Boost Regulator – Buck-Boost Regulator – Cuk Regulator – Comparison of Regulators – closed loop control techniques.		
UNIT –II	**Voltage Control of Single Phase Inverter**	**Hours: 08**
PWM – Single Pulse Width Modulation – Multiple Pulse Width Modulation – Sinusoidal Pulse Width Modulation – Modified Sinusoidal Pulse Width Modulation – Phase Displacement Control – Advanced Modulation Control Techniques.		
UNIT –III	**Voltage Control of Three Phase Inverter**	**Hours: 06**
Sinusoidal PWM – 60 Deg PWM – Third Harmonic PWM – Space Vector Modulation – Comparison of PWM techniques – Current Source Inverter – Variable DC link inverter.		
UNIT-IV	**Multilevel inverter**	**Hours: 06**
Diode Clamped Multilevel Inverter – Principle of operation – Features – Improved Diode Clamped Multilevel Inverter. Flying Capacitor Multilevel Inverter - Principle of operation – Features. Cascaded Multilevel Inverter - Principle of operation – Features.		
UNIT –V	**Power Factor Improvement**	**Hours: 08**
Extinction Angle Control – Symmetrical Angle Control – PWM control – Single Phase Sinusoidal PWM – Three Phase PWM Rectifier.		

Course Outcomes: At the end of this course students will be able to

CO1: Design and analyze the performance of DC-DC converters.

CO2: Acquire the knowledge about different types of Single phase PWM modulation strategies.

CO3: Acquire the knowledge about different types of Three phase PWM modulation strategies.

CO4: Design simulated models for the analysis of different topologies of multilevel inverter.

CO5: Understand the basics in PF improvement.

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		2											3
CO2	3		2											3
CO3	3		2											3
CO4	3		2											3
CO5	3		2											3

Text Books:

1. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint- 2008.
2. Power Electronics- Ned Mohan, Tore M.Undelan and William P.Robbins –John Wiley& Sons -2nd Edition.Power Electronics – Lander –Ed.2009.

Reference Books:

1. Modern power Electronics and AC Drives – B.K.Bose.

CONTROL SYSTEMS DESIGN
(Professional Elective-III)

Subject Code: UGEE7T0322	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Control Systems

Course Objective: This course aims to introduce the aspects of designing and operating an automated process so that it maintains specifications on profitability, quality, safety, environmental impact, etc.

Syllabus

UNIT I: Design Specifications **6hrs**

Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

UNIT II: Design of Classical Control System in the Time Domain **8hrs**

Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

UNIT III: Design of Classical Control System in Frequency Domain **8hrs**

Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

UNIT IV: Design of PID Controllers **6hrs**

Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

UNIT V: Control System Design in State Space **8hrs**

Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

Course Outcomes: At the end of this course students will be able to

CO1: Explain the design problem and related specifications in time and frequency domains

CO2: Identify appropriate compensator/ controller and apply the design procedure for the Estimating the parameters of simple controller structures (P, PI, PID, compensators)

CO3: Apply the design procedures to select appropriate state feedback control and observer gains for the specified design requirements

CO-PO MAPPING:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		3											3
CO2	3		3										2	3
CO3	3		3											3

TEXT BOOKS:

1. "Control Systems Engineering Norman S. Nise, Wiley, 6th Edition, 2012.
2. "Modern Control Engineering", Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
3. "Control Systems: Principles and Design", M. Gopal, Mcgraw Higher Ed, 4th Edition, 2012
4. "Control Systems Engineering", I. J. Nagrath and M. Gopal, New Age International Ltd., 2nd Edition, 2006.

REFERENCE BOOKS:

1. "Digital Control Engineering", M Gopal, New Age International Ltd., Publishers, 2nd Edition, 2014.
2. "Linear control system analysis and design (conventional and modern)",J. J. D'Azzo and C. H. Houpis, Mcgraw Higher Ed, 4th Edition, 1995.
3. "Design of feedback Control Systems", R. T. Stefani and G. H. Hostetter, Saunders College Pub., 3rd Edition, 1994.

GREEN ENERGY & CONTROL

(Professional Elective-III)

Subject Code: UGEE7T0422	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**-**	**-**	**3**

Course Objective:

This course introduces the Green energy generation and control with relevant Power Electronic converters for different applications.

Syllabus

UNIT –I	**Solar Power Generation**	**Hours: 08**
Solar Photovoltaic Systems - Balance of systems – IV characteristics – Maximum Power Point Tracking techniques: Perturb and Observe (P&O) technique – Hill climbing technique.		
UNIT –II	**Wind Power Generation**	**Hours: 08**
Wind Energy - Wind patterns – Types of turbines – Kinetic Energy of Wind – Betz coefficient – Tip–Speed ratio – Efficiency – power output of wind turbine – selection of generator (synchronous, induction)		
UNIT –III	**Power circuit for Photovoltaic energy - I**	**Hours: 06**
Buck Converter topology - Discontinuous Conduction Mode. Boost Converter - Analysis of the Boost Converter. Buck-Boost Converter. Flyback Converter - Flyback topology and operation.		
UNIT – IV	**Power circuit for Photovoltaic energy - II**	**Hours: 06**
Forward Converter - Forward topology and operation. Capacitive Converters - Capacitive Voltage Doubler - Analysis of the Capacitive Voltage Doubler.		
UNIT –V	**Power circuit for Wind energy**	**Hours: 08**
Inverters - Basic inverter. Power Factor Correction - Power Factor - PFC Corrected Converter - PFC Controller. Soft Switching - Quasi-Square-Wave Converter.		

Course Outcomes : At the end of this course students will be able to
CO1: Acquire the knowledge Solar power generation.
CO2: Acquire the knowledge Wind power generation.
CO3: Design and implementation of different converters for the control and conversion of Green energy.

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3						2							
CO2	3						2							
CO3	3													3

Text Books:

1. Non Conventional Energy Sources, G.D. Rai, khanna publishers.
2. https://web.stanford.edu/class/ee152/resources/course_notes_092416.pdf

Reference Books:

1. Solar energy: principles of thermal collection and storage, s. P. Sukhatme and j. K. Nayak, tmh, new delhi, 3rd edition.

HIGH VOLTAGE ENGINEERING
(Professional Elective-III)

Sub Code: UGEE7T0522	**L**	**T**	**P**	**C**
IV YEAR-I SEM	**3**	**-**	**-**	**3**

Prerequisites: Fundamentals of mathematics, chemistry and knowledge of circuit analysis and power system fundamentals**.**

Course Objectives: The aim of this course is to learn the importance principles and of HV generation, measurement, numerical study of electrostatic field computation methods, break down properties of gas, solid, and liquid dielectrics. Non-destructive testing of electrical apparatus.

Syllabus

UNIT –I Introduction to High Voltage Technology Hours: 08

Electric Field Stresses – Uniform and non–uniform field configuration of electrodes – Estimation and control of electric Stress – Numerical methods for electric field computation.

UNIT –II Break down phenomenon in gaseous, liquid and solid Hours: 08

Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases – Paschen's law – Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquid – Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown – Breakdown of solid dielectrics in practice – Breakdown in composite dielectrics used in practice.

UNIT –III Generation of High voltages and High currents Hours: 09

Generation of high DC voltages – Generation of high alternating voltages – Generation of impulse voltages – Generation of impulse currents – Tripping and control of impulse generators.

UNIT –IV Measurement of high voltages and High currents Hours: 08

Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse.

UNIT –V Non–destructive testing of material and testing of electrical apparatus. Hours: 08

Measurement of DC resistivity – Measurement of dielectric constant and loss factor – Partial discharge measurements. Testing of insulators and bushings – Testing of isolators and circuit breakers – Testing of cables – Testing of transformers – Testing of surge arresters.

Course Outcomes: At the end of this course students will be able to

CO1: To be acquainted with the performance of high voltages with regard to different configurations of electrode systems.

CO2: To be able to analyze the theory of breakdown and withstand phenomena of all types of dielectric materials.

CO3: To acquaint with the techniques of generation of AC, DC and Impulse voltages.

CO4: To be able to apply knowledge for measurement of high voltage, high current AC, DC ,Impulse and non destructive testing of electrical apparatus

CO5: To analyze the techniques of testing various equipment‘s used in HV engineering.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P12	PSO1	PSO2
CO1	3	3	3											
CO2	3	3	3											
CO3	3	3	3	3										
CO4	3	3	3	3	2	3								
CO5	3	3	3	2	2	3								

TextBooks:

1. “High Voltage Engineering” by M. S. Naidu and V. Kamaraju – TMH Publications, 3rd Edition
2. “High Voltage Engineering: Fundamentals” by E. Kuffel, W. S. Zaengl, J. Kuffel by Elsevier, 2nd Edition.
3. “High Voltage Engineering and Technology” by Ryan, IET Publishers.

Reference Books:

1. “High Voltage Engineering” by C. L. Wadhwa, New Age Internationals (P) Limited, 1997.
2. “High Voltage Insulation Engineering” by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.

ELECTRICAL DISTRIBUTION SYSTEMS
(Professional Elective IV)

Subject Code: UGEE7T0622	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**-**	**-**	**3**

Prerequisites: Power systems generation & transmission

Course Objective: This subject deals with the general concept of distribution system, substations and feeders as well as discusses distribution system analysis, protection and coordination, voltage control and power factor improvement**.**

Syllabus

UNIT – I	**GENERAL CONCEPTS**	**Hours: 09**

Introduction to distribution systems, Classification of Distribution Systems - Classification of distribution systems, design features of distribution systems, radial distribution, ring main distribution, Load modeling and characteristics – 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.

UNIT – II	**SUBSTATIONS & DISTRIBUTION FEEDERS**	**Hours: 10**

Air insulated substations - Substations layout - Bus bar arrangements: single bus bar, sectionalized single bus bar, main and transfer bus bar system. Gas insulated substations (GIS)-single line diagram - Location of substations: Rating of distribution substation – Service area within primary feeders – Benefits derived through optimal location of substations.

Design Considerations of distribution feeders: Radial and loop types of primary feeders – Voltage levels – Feeder loading – Basic design practice of the secondary distribution system.

UNIT – III	**VOLTAGE DROP AND POWER LOSS**	**Hours: 09**

Voltage Drop Calculations in D.C Distributors for: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor, A.C. Distributors - Power Factors referred to receiving end voltage and with respect to respective load voltages - Numerical Problems, Three phase balanced primary lines.

UNIT – IV	PROTECTION & COORDINATION	Hours: 09

Objectives of distribution system protection - types of common faults - procedure for fault calculations, over current Protective Devices: Principle of operation of Fuses, Auto-Circuit Recloser - Auto-line sectionalizes - circuit breakers. Coordination of Protective Devices: Objectives - general coordination procedure - Fuse to Fuse-Auto-Recloser to Fuse, Circuit breaker to Fuse, Circuit breaker to Auto-Recloser

UNIT – V	POWER FACTOR IMPROVEMENT & VOLTAGE CONTROL	Hours: 09

Causes of low Power Factor - Capacitive compensation for power factor control – Methods of Improving PF - Power factor correction – Capacitor allocation – Effect of shunt capacitors (Fixed and switched) - Most economical PF for constant KW load and constant KVA type loads - Procedure to determine the best capacitor location.

Voltage Control: Equipment for voltage control – Effect of series capacitors– Effect of AVB/AVR –Line drop compensation

Course Outcomes: At the end of this course students will be able to

CO1: explain the various concepts of distribution system

CO2: analyze the substation and distribution feeders

CO3: determine the voltage drop and power loss in distribution feeders

CO4: interpret the protection and its coordination.

CO5: explain power factor improvement and voltage control concepts

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

Text Books:

1. Electric Power Distribution system, Engineering" – by Turan Gonen, McGraw–hill Book Company.
2. Electrical Distribution Systems by Dale R.Patrick and Stephen W.Fardo, CRC press
3. Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing Company, 4th edition, 1997.
4. Dr M K Khedkar and Dr G M Dhole, "A Textbook of Electric Power Distribution Automation", University

Reference Books:

1. Electrical Power Distribution &Automation by S.Sivanagaraju & V.Shankar, Dhanpat Rai & Co
2. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.
3. D. Bassett, K. Clinard, J. Grainger, S. Purucker, and D.Ward, "Tutorial Course: Distribution Automation", IEEE Tutorial Publication 88EH0280-8-PWR, 1988.

Hybrid Electric Vehicles
(Professional Elective-IV)

Subject Code: UGEE7T0722	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**-**	**-**	**3**

Course Objective:

This course introduces a comprehensive overview of Electric Vehicles.

Syllabus

UNIT –I	**CONVENTIONAL VEHICLES**	**Hours: 08**
Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.		
UNIT –II	**ELECTRIC DRIVE-TRAINS**	**Hours: 08**
Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies.		
UNIT –III	**ELECTRIC PROPULSION UNIT**	**Hours: 06**
Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.		
UNIT – IV	**ENERGY STORAGE**	**Hours: 06**
Introduction to Energy Storage Requirements in Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis.		
UNIT –V	**SIZING THE DRIVE SYSTEM**	**Hours: 08**
Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems		

Course Outcomes: At the end of this course students will be able to
CO1: Explore basic concepts of conventional electric vehicle.
CO2: Analyze the performance of basic traction and related power flow.
CO3: Evaluate the performance of different motors for electric vehicle propulsion.
CO4: Analyze the energy storage systems.
CO5: Demonstrate the sizing and alignment of components in EV.

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		2											1
CO2	3		2											1
CO3	3		2											3
CO4	3		2											3
CO5	3		2											3

Text Books:

1. "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", C. Mi, M. A. Masrur and D. W. Gao, John Wiley & Sons, 1st Edition, 2011.
2. "Hybrid Electric Vehicles: Energy Management Strategies", S. Onori, L. Serrao and G. Rizzoni, Springer, 1st Edition, 2015.
3. "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", M. Ehsani, Y.Gao, S. E. Gay and A. Emadi, CRC Press, 1st Edition, 2004.

Reference Books:

1. "Electric and Hybrid Vehicles", T. Denton, Routledge, 1st Edition, 2016.

Wind & Solar Energy Systems
(Professional Elective-IV)

Subject Code: UGEE7T0822	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Pre-requisites: Power systems Generation and Transmission

Course Objectives: To Understand the Basic physics, topologies,theory of wind and solar, power electronics converter interface grid integration of solar and wind**.**

UNIT I: Physics of Wind Power (Hours: 07)

History of wind Energy, Indian and Global statistics, Advantages and disadvantages of wind Energy, Wind power, Betz limit, Tip speed ratio, stall and pitch control, Basic Components of wind energy conversion system, Selection of site for wind energy conversion system, classification of wind mills based on axis of rotor

UNIT II: Wind Generator Topologies (Hours: 07)

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators

UNIT III: The Solar Resource (Hours: 06)

Introduction, Measurement of Solar Radiation, Solar Radiation Data, Solar Insolation, Solar energy collectors , solar energy storage systems, Solar Thermal Power plant

UNIT IV: Solar Photovoltaic Technologies (Hours: 07)

Principle of Solar PV , Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms

UNIT V: Classification of PV Systems and Design (Hours: 08)

Classification of PV System-Standalone PV system, grid Interactive PV System, small system for consumer applications, hybrid solar PV system. System Components - PV arrays, inverters, batteries, and charge controllers, net power metering. PV array installation, operation, costs, reliability

Course Outcomes:

At the end of the course, students will be able to,
CO1: To Able to understand the concept of physics behind the wind power
CO2: Understand and design of different topologies of wind generators
CO3: Understand the basic concepts of solar resources
CO4: Understand the basic theory behind the solar photovoltaic technologies
CO5: Able to classify the different PV systems and Design the PV systems with different Topologies

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3										2		
CO2	3	3										2		
CO3	3	3										2		
CO4	3	3										2		
CO5	3	3										2		

TEXT BOOKS:

1. "Wind Power in Power Systems" T. Ackermann, John Wiley and Sons Ltd., 1st Edition,
   2005
2. "Solar Photovoltaic: "Fundamentals, Technologies and Application" Chetan Singh Solanki., PHI Learning Pvt., Ltd., 1st Edition, 2009.

REFERENCE BOOKS:

1. "Renewable and Efficient Electric Power Systems", G. M. Masters, John Wiley and Sons, 1st Edition, 2004.
2. "Solar Energy: Principles of Thermal Collection and Storage", S. P. Sukhatme, McGraw Hill, 1st Edition, 1984.
3. "Grid integration of wind energy conversion systems", H. Siegfried and R. Waddington, John Wiley and Sons Ltd., 2nd Edition, 2006.
4. "Renewable Energy Applications", G. N. Tiwari and M. K. Ghosal, Narosa Publications, 1st Edition, 2004.
5. "Solar Engineering of Thermal Processes", J. A. Duffie and W. A. Beckman, John Wiley & Sons, 2nd Edition, 1991.

POWER QUALITY

(Professional Elective-IV)

Subject Code: UGEE7T0922	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**-**	**-**	**3**

Prerequisites: Fundamentals of Power Systems and Power Electronics

Course Objective: This main objective of this course is to study various power quality issues, voltage regulation, and transient over voltages, distributed generation, power quality monitoring and measurement equipment.

Syllabus

UNIT –I Overview of Power Quality Hours: 12

Concern about the Power Quality - General Classes of Power Quality Problems – Transients -Long-Duration Voltage Variations - Short Duration Voltage Variations - Voltage Unbalance - Waveform Distortion - Voltage fluctuation - Power Frequency Variations - Power Quality Terms - Voltage Sags and Interruptions - Sources of Sags and Interruptions – Nonlinear loads.

UNIT –II Transient over Voltages Hours: 12

Source of Transient over Voltages - Principles of Over Voltage Protection - Devices for Over Voltage Protection - Utility Capacitor Switching Transients - Utility Lightning Protection - Load Switching Transient Problems.

UNIT –III Harmonic distortion and solutions Hours: 12

Voltage vs. Current Distortion - Harmonics vs. Transients - Power System Quantities under Non-sinusoidal Conditions - Harmonic Indices – Sources of harmonics -Effects of Harmonic Distortion – solutions for mitigation of harmonics

UNIT – IV Long Duration Voltage Variations Hours: 12

Principles of Regulating the Voltage - Device for Voltage Regulation - Utility Voltage Regulator Application - Capacitor for Voltage Regulation - End-user Capacitor Application - Regulating Utility Voltage with Distributed Resources – Flickering

UNIT –V Monitoring and Instrumentation Hours: 12

Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data – PQ monitoring standards

Course Outcomes: At the end of this course students will be able to

CO1: Differentiate between different types of power quality problems

CO2: understand and analyze the concepts Transient over voltages.

CO3: understand the Harmonics distortion and apply the techniques to mitigate the harmonics

CO4: understand the principles of Voltage Regulation and flickering

CO5: apprehend the power quality monitoring concepts and analyze measuring instruments.

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

TextBooks:

1. Electrical Power Systems Quality, Dugan R C, McGranaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw-Hill, 2002.

2. Power Quality Primer, Kennedy B W, First Edition, McGraw-Hill, 2000.

Reference Books:

1. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M H J, First Edition, IEEE Press; 2000.

2. Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley & Sons, 2003.

3. Power Quality by C.Shankaran, CRC Press,2001

DATA SCIENCE
(Professional Elective-IV)

Subject Code: UGEE7T1022	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Control Systems

Course Objective: This course aims to introduce the aspects of designing and operating an automated process so that it maintains specifications on profitability, quality, safety, environmental impact, etc.

Syllabus

UNIT I: Introduction to Core Concepts and Technologies **6hrs**

Introduction, Terminology, data science process, data science toolkit, Types of data, example applications.

UNIT II: Data Collection and Management **8hrs**

Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

UNIT III: Data Analysis **8hrs**

Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT IV: Data Visualization **6hrs**

Introduction, Types of data visualization, Data for visualization- Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

UNIT V: Applications of Data Science **8hrs**

Technologies for visualization, Bokeh (Python), recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Course Outcomes: At the end of this course students will be able to

CO1: Describe the fundamental principles and terminologies of data science, recognizing the data science process and its core toolkit.

CO2: Apply appropriate methods for data collection, management, and analysis, including the use of APIs, statistical measures, and basic machine learning algorithms.

CO3: Design and develop compelling data visualizations using various tools and techniques, emphasizing the correct usage of data encodings and visual mappings.

CO4: Critique and assess the effectiveness of various data science applications, recognizing emerging trends and best practices in data collection, analysis, and visualization.

CO-PO MAPPING:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3				3									
CO2	3				3									
CO3	3				3									
CO4	3				3									

Text Books:

1. "The Art of Data Science", 1st edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015

2."Algorithms for Data Science", 1st edition, Steele, Brian, Chandler, John,Reddy, Swarna, springers Publications, 2016

Reference Books:

1.Doing Data Science: Straight Talk From The Frontline, 1st edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

2.Mining of Massive Datasets, 2nd edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014

ENERGY AUDIT, CONSERVATION AND MANAGEMENT
(Professional Elective -V)

Subject Code: UGEE7T1122	**L**	**T**	**P**	**C**
IV Year / Semester-I	**3**	**-**	**-**	**3**

Prerequisites: Fundamentals of energy systems.

Course Objective:

1. To facilitate the students to achieve a clear conceptual understanding of technical and commercialaspects of energy conservation and energy auditing.

2. To enable the students to develop managerial skills to assess feasibility of alternative approachesand drive strategies regarding energy conservation and energy management.

Syllabus

UNIT –I Basic Principles of Energy Audit **Hours: 09**

Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energyaudit of process industry, building energy audit.

UNIT –II Energy Management **Hours: 09**

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language, Questionnaire -check list for top management.

UNIT –III Energy Efficient Lighting **Hours: 08**

Introduction, terms used in illumination–Laws of illumination-Luminous efficiency – Types of lamps Typesof lighting Electric lighting fittings (luminaries) Flood lighting– White light LED – Energy conservation Measures

UNIT – IV Power Factor and energy instruments **Hours: 07**

Methods of Power factor improvement – Location of capacitors – Energy Instruments – Watt– hour – meterData loggers –Thermocouples-Pyrometers-Lux meters- -Tong testers– Power analyzer.

UNIT –V Economic Aspects and Analysis **Hours: 09**

Economics Analysis –Depreciation Methods –Time value of money Rate of return Present worth method –Replacement analysis –Life cycle costing analysis, – simple payback method .

Course Outcomes: At the end of this course students will be able to

CO1: Understand the significance and procedure for energy conservation and audit.

CO2:. Understand the fundamentals of energy management functions.

CO3: Analyze, calculate and improve the energy efficiency and performance of electrical utilities.

CO4: Analyze the power factor and increase the efficiency of energy instruments.

CO5: Understand the economic analysis and system energy management for electrical system , pay back periods for energy saving equipment.

Mapping of COs to POs:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3											
CO2	3	3	3											
CO3	3	3	3											
CO4	3	3	3	3		2								
CO5	3	3	3	3	2	3								

Text Books:

1. Energy management by W.R. Murphy AND G. McKay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
3. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd–2nd edition, 1995.

Reference Books:

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd.New Delhi.
2. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998.
3. Energy management hand book by W.C.Turner, John wiley and sons.
4. Energy management and conservation –k v Sharma and pvenkata seshaiah-I K International PublishingHouse pvt.ltd,2011.
5. http://www.energymanagertraining.com/download/Gazette_of_IndiaPartIISecI-37_25-08-2010.pdf

Smart Grid
(Professional Elective -V)

Subject code: UGEE7T1222	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Fundamentals of power system and ICT for smart grid.

Course Objectives: The aim of this course is to study the fundamental of smart grid technology, Wide area measurement system of the smart grid, smart meters and power quality management and information and communications in smart grid.

UNIT-I: Introduction to Smart Grid: **Hours:09**
Introduction to Smart Grid - Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid.
UNIT-II: Smart Grid Architecture: **Hours:09**
Components and Architecture of Smart Grid Design, The fundamental components of Smart Grid designs – Concept of Transmission Automation and Distribution Automation.
UNIT-III: Wide Area Monitoring System: **Hours:10**
Introduction to Synchro phasor Network-Synchro phasor network elements –Phasor Measurement Unit (PMUs) – Working Principle of PMU –Phasor data concentrator- functions of PDC –Wide Area Measurement system definition –WAMS process - Architecture of Wide Area Measurement Systems (WAMS)- functions of WAMS.
UNIT-IV: Smart Metering and ICT for smart grid: **Hours:09**
Introduction, smart metering – evolution of electricity metering, key components of smart metering- Smart metering infrastructure -smart meters: an overview of the hardware used.
Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).
UNIT-V: Power Quality Management in Smart Grid: **Hours:10**
Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Course Outcomes:
CO1: Acquire the knowledge on smart grid and development of smart grid architecture.
CO2: Analyze the wide area monitoring system and acquire the knowledge of smart meters.
CO3: Analyze the power quality issues in smart grid.

CO – PO Mapping														
POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO**
CO1	3	3	3											
CO2	3	3	3	3	3									
CO3	3	3	3	3	3									

Text Books:

1. "Smart Grids, Infrastructure, Technology and Solutions" by Stuart Borlase, CRC Press, 1e, 2013.

2. "Synchronized Phasor Measurements and their Applications", by A.G. Phadke and J.S. Thorp, Springer Edition, 2e, 2017.

3. "Integration of Green and Renewable Energy in Electric Power Systems", by Ali Keyhani, Mohammad N. Marwali, Min Dai Wiley online library.

4. "The Smart Grid: Enabling Energy Efficiency and Demand Response", by Clark W. Gellings, CRC Press.

Reference Books:

1. "Smart Grid", by Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012.

2." Smart Grid: Fundamentals of Design and Analysis", by James Momoh, Wiley, IEEE Press., 2012. Publishers, 2013.

3. "Smart Grid: Technology and Applications", by JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, AkihikoYokoyama, Wiley student edition.

4., "Smart Grids", by Jean Claude Sabonnadière, NouredineHadjsaïd Wiley Blackwell 19

5 "Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities", by . Peter S. Fox Penner, Island Press; 1 edition 8 Jun 2010

6. "Smart Grids (Power Engineering)", by Stuart Borlase CRC Press.

7. "The Advanced Smart Grid: Edge Power Driving Sustainability: 1", by Andres Carvallo, John Cooper, Artech House Publishers July 2011.

PROGRAMMABLE LOGIC CONTROLLERS & APPLICATIONS

(Professional Elective-V)

Subject Code: UGEE7T1322	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Digital electronics, Control Systems

Course Objective: To make the students aware about the automation used in various industrial applications and the use of PLC in different processes

Syllabus

UNIT –I	**PLC BASICS**	**Hours: 06**
PLC system, I/O modules and interfacing, CPU processor, programming Equipment, Programming formats, construction of PLC ladder diagrams, Devices connected to I/O modules.		
UNIT –II	**PLC PROGRAMMING**	**Hours: 06**
Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.		
UNIT –III	**PLC REGISTERS**	**Hours: 08**
PLC Registers: Characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers.		
UNIT – IV	**PLC FUNCTIONS -I**	**Hours: 08**
Timer functions & Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number Comparison functions, Number Conversion functions. Data Handling functions: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep functions and their applications.		
UNIT –V	**ANALOG PLC OPERATION**	**Hours: 08**
Analog modules & systems, Analog signal processing, Analog output Application Examples, PID principles, PID Modules, PID tuning, PID functions		

Course Outcomes: At the end of this course students will be able to

CO1: Interpret PLC system and construction of PLC ladder diagrams

CO2: Apply the knowledge of PLC programming on some case studies

CO3: Describe characteristics of registers and conversion examples

CO4: Apply PLC functions to timing and counting applications

CO5: Analyze the analog operations of PLC

CO – PO Mapping														
POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												
CO6	3	3												

TEXTBOOKS:

1. "Programmable Logic Controllers: Principles and Applications", John W. Webb, Ronald A. Reis Prentice Hall, 2003 - Technology & Engineering
2. "Programmable Logic Controllers- Programming Method and Applications", Jr. Hackworth & F.D Hackworth Jr., Pearson Education,1st edition, 2003.
3. "Introduction to Programmable Logic Controllers", Delmar Thomas, Cengage Learning, 3rd edition, 2007.

REFERENCE BOOKS:

1. "W. Bolton", Programmable Logic Controllers, Newnes, 4th Edition 2000.

ENERGY STORAGE TECHNOLOGIES
(Professional Elective-V)

Subject Code: UGEE7T1422	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**-**	**-**	**3**

Course Objective:

This course introduces the need for energy storage, devices and technologies available and their applications

Syllabus

UNIT –I	**Electrical Energy Storage Technologies**	**Hours: 08**
Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.		
UNIT –II	**Needs for Electrical Energy Storage**	**Hours: 08**
Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses, the role of electrical energy storage technologies: from viewpoint of a utility, consumers and generators of renewable energy.		
UNIT –III	**Features of Energy Storage Systems**	**Hours: 06**
Classification of EES systems , Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES),Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2),Synthetic natural gas (SNG).		
UNIT – IV	**Types of Electrical Energy Storage systems**	**Hours: 06**
Electrical storage systems, Double-layer capacitors (DLC) ,Superconducting magnetic energy storage (SMES),Thermal storage systems, Standards for EES, Technical comparison of EES technologies.		
UNIT –V	**Energy Storage Applications-I**	**Hours: 08**
Present status of applications, Utility use (conventional power generation, grid operation & service) , Consumer use (uninterruptable power supply for large consumers), New trends in applications , Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems.		

Course Outcomes: At the end of this course students will be able to
CO1: Analyze the characteristics of energy from various sources and need for storage.
CO2: Classify various types of energy storage and various devices used for the purpose.
CO3: Identify various real time applications.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													
CO2	3													
CO3	3	3												

Text Books:

1. "James M. Eyer, Joseph J. Iannucci and Garth P. Corey ", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board.

Reference Books:

1. "Jim Eyer, Garth Corey", Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

MODELING AND ANALYSIS OF ELECTRICAL MACHINES
(Professional Elective-V)

Subject Code: UGEE7T1522	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Electrical Machines-I, Electrical Machines-II

Course Objective: To understand mathematical modeling of electrical machines in detail.

Syllabus

UNIT –I	**Basic concepts of Modeling**	**Hours: 08**
Basic Two-pole Machine representation of Commutator machines, 3-phasesynchronous machine with and without damper bars and 3-phase induction machine,Kron's primitive Machine-voltage, current and Torque equations.		
UNIT –II	**DC Machine Modeling**	**Hours: 08**
Mathematical model of separately excited D.C motor – Steady State & Transient State analysis-Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor- Mathematical modeling of DC Series Motor		
UNIT –III	**Modeling of Single Phase Induction Machine**	**Hours: 08**
Reference frame theory & Modeling of single phase Induction Machines Linear transformation Phase transformation - three phase to two phase transformation (abc to dq0) and two phase to three phase transformation dq0 to abc-Power equivalence- Mathematical modeling of single phase induction machines		
UNIT – IV	**Modeling of three phase Induction Machine:**	**Hours: 08**
Generalized model in arbitrary reference frame Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model-state space model with flux linkages as variables		
UNIT –V	**Modeling of Synchronous Machine**	**Hours: 08**
Synchronous machine inductances–voltage equations in the rotor's dq0 reference frame-electromagnetic torque-current in terms of flux linkages-three synchronous machine model- modeling of PM Synchronous motor		

Course Outcomes: At the end of this course students will be able to
CO1: Able to understand the basic concepts of various electrical rotating machines and to model DC machine.
CO2: Able to model single phase induction machines through reference frame theory.
CO3: Able to develop three phase induction machine model through stator reference model, rotor reference model, synchronously rotating reference frame and state space model.
CO4: Able to analyze synchronous machines, permanent magnetic synchronous machines, BLDC and SRM using dq0 reference frame

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3		3										
CO2	3	3												
CO3	3	3	3											
CO4	3	3		3										

TextBooks:
1. "Electric Motor Drives - Modeling, Analysis& control", R. Krishnan.Pearson Publications- 1st edition -2002 2. "Analysis of Electrical Machinery and Drive Systems", by P. C. Krause, O. Wasynczuk, S. D. Sudhoff, – Second Edition-IEEE Press
ReferenceBooks:
1. "Dynamic simulation of Electric Machinery using MATLAB / Simulink" – Chee MunOng, Prentice Hall 2. "Generalized Theory of Electrical Machines", by P. S. Bhimbra, Khanna Publishers

Battery Management System
(Job Oriented Elective - III)

Subject Code: UGEE7T1622	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**-**	**2**	**3**

Course Objective:
This course introduces the Battery management system and its requirements with modeling and design considerations.

Syllabus

UNIT –I	**Battery Management system: Introduction**	**Hours: 08**
Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging.		
UNIT –II	**Battery Management System Requirement:**	**Hours: 08**
Introduction and BMS functionality, Battery pack topology, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation.		
UNIT –III	**Battery State of Charge and State of Health Estimation, Cell Balancing:**	**Hours: 06**
Battery state of charge estimation (SoC), voltage-based methods to estimate SoC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing.		
UNIT – IV	**Modeling and Simulation:**	**Hours: 06**
Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modeling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs		
UNIT –V	**Design of BMS:**	**Hours: 08**
Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system		

CO – PO Mapping														
POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													
CO2	3	2												2

Course Outcomes : At the end of this course students will be able to
CO1: Acquire the knowledge about Battery Management system and requirements
CO2: Acquire the knowledge about Modeling and design

Text Books:

2. V. Pop, H.J. Bergveld, D. Danilov, P.P.L. Regtien, P.H.L Notten, "Battery management systems: Accurate state-of-charge indication for battery-powered applications" Springer Science & Business Media, Vol. 9. 2008.
3. H.J. Bergveld, W.S Kruijt., P.H.L Notten, "Battery Management Systems -Design by Modelling", Philips Research Book Series; Springer Science & Business Media, 2002.
4. X. Rui, "Battery Management Algorithm for Electric Vehicles", Springer, 1st edition, 2020
4. K. T. Chau, "Energy Systems for Electric and Hybrid Vehicles", The Institution of Engineering and Technology, 2016.

Reference Books:

1. G. L. Plett, "Battery management systems, Vol. I: Battery modeling", Artech House, 2015.
2. G L Plett, "Battery management systems, Vol II: Equivalent-circuit methods", Artech House, 2015.

SOFTWARE ENGINEERING

(Open Elective-II)

Subject Code: UGCS0T1422	**L**	**T**	**P**	**C**
IV Year/ I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with at least one computer programming language.

Course Objectives:
In this course,

1. The student learns and gain practical experience with software engineering principles and techniques.
2. The practical experience centers on team project in which a software development project is carried through the various stages of the software lifecycle.

Syllabus:

UNIT I: (6 Lectures)
Introduction to Software Engineering: The Evolving Role of Software, Changing Nature of Software, Software Myths.
The Software Problem: Cost, Schedule and Quality, Scale and Change.

UNIT II: (8 Lectures)
Software Process: Process and Project, Component Software Process, Software Development Process Models : Waterfall Model, Prototyping, Iterative Development, Relational Unified Process, Time Boxing Model, Extreme Programming and Agile Process, Using process models in a Project, Project Management Process.

UNIT III: (7 Lectures)
Software Requirement Analysis and Specification: Value of Good SRS, Requirement Process, Requirement Specification.
Functional Specifications with use-cases, Other approaches for analysis, Validation.

UNIT IV: (7 Lectures)
Planning a Software Project: Effort Estimation, Project Schedule and Staffing, Quality Planning, Risk Management Planning, Project Monitoring Plan, Detailed Scheduling.
Software Architecture and Design: Role of Software Architecture, Components and Connector View, Characteristics of Good Design, Design Principles, Modular Design, Design Methodologies, Detailed design.

UNIT V: (7 Lectures)
Software Implementation and Testing: Coding Techniques, Structural and Object Oriented, Software Quality, CMM Levels, Testing Concepts, Black-Box and White-Box Testing, Art of Debugging.

Course Outcomes:
Upon completion of this course, the students will be able to:
CO 1. Make use of the software development life cycle principles and process

models.

CO 2. Construct the software requirements specifications with relevant use-cases.

CO 3. Analyze the project management strategies and various components to build the architecture using suitable design strategies.

CO 4. Estimate the best coding standards and testing strategies to develop high quality software products.

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	-	-	2	-	-	-	-	-	2	-	-
CO2	3	3	3	-	2	2	-	-	2	2	-	2	-	-
CO3	3	3	3	-	2	2	-	-	2	2	3	2	-	-
CO4	3	3	3	-	2	2	-	-	-	-	-	2	-	-

TEXT BOOKS:

1. Pankaj Jalote, A Concise Introduction to Software Engineering (Undergraduate Topics in Computer Science), Springer International Edition.

2. Roger S Pressman, "Software Engineering – A Practitioner's Approach", 7th Edition, McGrawHill.

3. Ugrasen Suman, Software Engineering Concepts and Practices, Cengage Learning Publications.

REFERENCE BOOKS:

1. K.K.Agarwal& Yogesh Singh. Software Engineering, New Age International Publishers.

2. Rajesh Naik and Swapna Kishore: Software Requirements and Estimation, 1st edition, Tata Mc Graw Hill.

3. Waman S Jawadekar , Software Engineering Principles and Practice, Tata Mc Graw Hill.

4. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education.

ARTIFICIAL INTELLIGENCE IN ELECTRICAL ENGINEERING

(Job Oriented Elective-IV)

Subject Code: UGEE7T1722	**L**	**T**	**P**	**C**
IV Year/I Semester	**2**	**-**	**2**	**3**
Prerequisites:Power System Analysis				

SYLLABUS

UNIT–I	**Introduction**	**Hours:10**
Introduction to Artificial neural networks-BiologicalNeuralNetworks-comparison between artificial and biological neural network-Basic building blocks of ANN-network architectures,setting the weights-supervised training, unsupervised training and reinforcement training-activation functions-ANN Terminologies.		
UNIT–II	**Models of NeuralNetworks**	**Hours:12**
Learning rules-Hebbian, Perceptron, Delta, out-star, competitive, Boltzmann learning-,MCCulloch-pitts neuron model-Hebb Net-single layerPerceptron model- Back propagation neural networks – Radial basis function networks-Discrete Hopfield networks..		
UNIT–III	**Geneticalgorithms&Modeling**	**Hours:12**
Introduction-Encoding-Binary, Tree encoding-fitness function-reproduction operators-Roulette-wheel selection, Boltzmann selection-cross over-single-site ,uniform cross over- mutation-generational cycle-convergence of genetic algorithm		
UNIT–IV	**FuzzyLogic**	**Hours:12**
Introduction to Fuzzy sets– Operations –Properties – Fuzzy relations– Membership functions- Fuzzification methods – Membership value assignment –Fuzzy rule based system– Defuzzification methods.		
UNIT-V	**ApplicationsofAITechniques:**	**Hours:12**
Load forecasting-Load flow studies-Economic load dispatch, Load frequency control-Single area system - Reactive power control-Speed control of DC and ACMotors.		

Course Outcomes: At the end of this course students will be able to
CO1: Comprehendfeedforwardneuralnetworks,feedbackneuralnetworksand
CO2: Modeling the genetic algorithms.
CO3: Developfuzzysets and logiccontrol
CO4: Apply AI techniques in electrical engineering.

MappingofCOstoPOs:														
POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S.Rajasekaran and G.A.Vijaya lakshmi Pai–PHI Publication.
2. IntroductiontoNeuralNetworksusingMATLAB6.0bySNSivanandam,SSumathi,SN Deepa ,TMGH.
3. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S.Rajasekaran and G.A.Vijaya lakshmi Pai–PHI Publication.
4. IntroductiontoNeuralNetworksusingMATLAB6.0bySNSivanandam,SSumathi,SN Deepa ,TMGH.

REFERENCEBOOKS:

1. Introduction to Artificial Neural Systems – Jacek M.Zurada, Jaico Publishing House, 1997.
2. Fundamentals of Neural Networks Architectures, Algorithms and Applications-by laureneFausett, Pearson.
3. Neural Networks, Algorithms, Applications and programming Techniques by James Freeman, David M. Skapura.

MANAGEMENT SCIENCE
(Common to all branches)

Subject Code : UGMB7T0122	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites:

- General awareness about Principles of Management.
- To have an insight about Production and Operations Management.
- To be able to acquire knowledge about Human Resource Management, Marketing, Strategic Management.

Course Objectives:

1. To create awareness about different Managerial concepts like Management, Production, Marketing, Human Resource and Strategic Management.
2. To make the students equip with knowledge on techniques of PERT and CPM in project management.

SYLLABUS:

UNIT-I: [8 Hrs]

Introduction to Management : Concept and importance of Management, Functions of management, Evaluation of Management thought, Fayol's principles of Management, Maslow's need hierarchy & Herzberg's two factor theory of Motivation, Decision making process, Designing organizational structure, Principles of Organization, Types of organization structures.

UNIT-II: [8 Hrs]

Operations Management : Plant Location Principles and types of plant Layout , Work study, Materials Management: Objectives - Need for inventory control- Inventory control techniques EOQ , ABC, HML, SDE, VED and FSN analysis.

UNIT-III: [12 Hrs]

Human Resources Management (HRM): Concepts of HRM, Basic functions of HR manager, Job Evaluation and Merit Rating, Performance Appraisal, Methods of Performance appraisal Concepts Compensation.

Marketing Management: Functions of marketing, Marketing Mix, Marketing strategies based on Product life cycle, Channels of distribution (Place), Promotional Mix.

UNIT-IV: [10 Hrs]

Project Management (PERT/CPM): Network analysis, Program Evaluation and Review Technique (PERT), Critical path method (CPM) - Identifying critical path, Difference between PERT & CPM (simple problems).

UNIT-V: **[8 Hrs]**

Strategic Management: Mission, Goals, objectives, policy, strategy, Environmental scanning, SWOT analysis, Steps in strategy formulation and implementation Generic strategy alternatives.

Course Outcomes:

Upon completing the course, student will be able to

COs	Description	Blooms Level
CO 1	Understand the fundamentals of Management with specific insight as its function and role	Understanding
CO 2	Learn the concepts of production, Management of human Resources and Management of Marketing activities along with business environment	Understanding
CO 3	Apply the problem solving skills to demonstrate logical solution to real life problems	Applying
CO 4	Create the awareness of business strategies to deal with the dynamic business environment	Creating

Mapping of COs to POs:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO 1	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO 2	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	2	-	-	-

Text Books:

T1. Dr. Arya Sri, "Management Science", TMH 2011.

T2. L.M. Prasad, "Principles & Practices of Management" Sultan chand & Sons, 2007.

Reference Books:

R1. K. Aswathappa and K. Sridhara Bhat, "Production and Operations Management", Himalaya Publishing House, 2010.

R2. Philip Kotler Philip Kotler, Kevin Keller, Mairead Brady, Malcolm Goodman, Torben Hansen, "Marketing Management" Pearson Education Limited, 2016.

DIGITAL CONTROLLER PROGRAMMING FOR POWER ELECTRONIC SYSTEMS LAB

Subject Code: UGEE7K1822	**L**	**T**	**P**	**C**
IV Year / I Semester	**1**	**-**	**2**	**2**

Course Objectives: To train students on the Digital Controller Code design for gate pulse generation related to the Power Electronic Converter control.

Syllabus

EXPERIMENTS:

1. Arduino code based Gate pulse generation for Three Phase Bridge Rectifier.
2. Arduino code based Gate pulse generation for Three Phase Inverter.
3. Arduino Programming with MATLAB and Simulink for PWM Pulse generation.
4. DSP Micro controller with MATLAB and Simulink model design for Three Phase Bridge Rectifier.
5. DSP Micro controller with MATLAB and Simulink model design for Three Phase Inverter.
6. DSP Micro controller with MATLAB and Simulink model design for PWM Pulse generation.
7. FPGA - VHDL code based pulse generation for Single Phase Bridge Rectifier.
8. FPGA - VHDL code based pulse generation for Three Phase Bridge Rectifier.
9. FPGA - VHDL code based pulse generation for Single Phase Inverter.
10. FPGA - VHDL code based pulse generation for Three Phase Inverter.

Course Outcomes: At the end of this course students will be able to,

CO1: Demonstrate the procedure and formatting for Logical codes.
CO2: Analyze the operation of Gate control pulse for various converter

CO – PO MAPPING:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3			2										3
CO2	3			3										3

SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN:: BHIMAVARAM
(AUTONOMOUS)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
Course Structure – R22
(With effect from AY: 2022-23)

Honors Syllabus
(for EEE Students)

S.No.	Course Code	Course Title	L	T	P	C	Pre Requisite
POWER ELECTRONICS							
1	UGEE4H0222	Renewable Energy Sources	3	1	0	4	Engineering Physics
2	UGEE5H0222	Power Semiconductor Devices	3	1	0	4	Analog Electronics
3	UGEE6H0222	Control Strategies for Power Electronic Converters	3	1	0	4	CS, ACS
4	UGEE7H0222	Electric Drives for Electric Vehicles	3	1	0	4	CS, ACS, DCS
5	UGEE0H3522	MOOC1	2	-	-	2	-
6	UGEE0H3622	MOOC2	2	-	-	2	-

Renewable Energy Sources
(Honors)

Subject Code: UGEE4H0222	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**1**	**0**	**4**

Prerequisite: Engineering Physics

Course Objective: The aim of this course is to understand the principle of operation of various renewable energy sources such as solar, wind, hydro, tidal, biomass, Geothermal, ocean energy and fuel cells.

Syllabus

UNIT –I Fundamentals of Energy Systems Hours: 08

Energy conservation principle – Energy scenario (world and India) – Solar radiation: Outside earth‘s atmosphere –– Energy Resources-Analysis of solar radiation data – Geometry Global climate change, CO2 reduction and potential of renewable energy-

UNIT –II Solar Energy Systems Hours: 08

Solar-Electrical Power Generation, General Solar Photo Voltaic (SVP) system, Different configurations, SPV system components and their characteristics, MPPT, instruments for measuring solar radiation, Applications of solar energy system.

UNIT –III Wind Energy Systems Hours: 08

Wind patterns – Types of turbines – Kinetic energy of wind – Betz coefficient – Tip–speed ratio – Efficiency – Power output of wind turbine – Classification of wind generators

UNIT – IV Hydro and Tidal energy systems Hours: 10

Basic working principle of small and micro hydro turbines – measurement of head and flow – Energy equation-Tidal power – Basics –energy equation –– Wave power – Basics –energy equation.

UNIT –V Biomass, Geothermal systems and Fuel Cells Hours: 08

Biomass Energy: Fuel classification – Pyrolysis – Direct combustion of heat – Different digesters and sizing. Fuel cell: Classification – Efficiency – VI characteristics.

Course Outcomes: At the end of this course students will be able to
CO1: Analyze solar radiation data, extra-terrestrial radiation and radiation on earth‘s surface.
CO2:Describe solar energy systems and maximum power point techniques in solar PV
CO3:Develop maximum power point techniques in wind
CO4: Explain basic principles and working of hydro, Tidal and wave energy systems
CO5: Interpret basic principle and working of biomass, geothermal systems and Fuel cells

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

TextBooks:

1. "Solar Energy: Principles of Thermal Collection and Storage", S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition.

2. "Renewable Energy Resources", John Twidell and Tony Weir, Taylor and Francis -second edition, 2013.

Reference Books:

1."Renewable Energy"- Edited by Godfrey Boyle-oxford university.press,3rd edition,2013.

2. "Handbook of renewable technology" Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore.

3. "Renewable Energy Technologies "/Ramesh & Kumar /Narosa.

POWER SEMICONDUCTOR DEVICES

Subject Code: UGEE5H0222	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**1**	**-**	**4**

Course Objective:

This course introduces the various semiconductor switching devices for the power converters.

Syllabus

UNIT –I	**Power switching devices overview and power diodes**	**Hours: 08**
Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching – Power diodes – Types, forward and reverse characteristics, switching characteristics – rating.		
UNIT –II	**Current Controlled Devices**	**Hours: 08**
BJT's – Construction, static characteristics, switching characteristics; Negative temperature coefficient and second breakdown; – Thyristors – Physical and electrical principle underlying operating mode, two transistor analogy – concept of latching; Gate and switching characteristics.		
UNIT –III	**Voltage Controlled Devices**	**Hours: 06**
Power MOSFETs and IGBTs – Principle of voltage-controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs – and IGCT.		
UNIT – IV	**Firing and Protecting Circuits**	**Hours: 06**
Necessity of isolation, pulse transformer, opto-coupler – Gate drives circuit: SCR, MOSFET,IGBTs and base driving for power BJT. – Over voltage, over current and gate protections; Design of snubbers.		
UNIT –V	**Thermal Protection**	**Hours: 08**
Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types.		

Course Outcomes: At the end of this course students will be able to
CO1: Determine the suitable device for the application.
CO2 : Design the gate drivers for switching devices.
CO3 : Design protection and control circuits.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		2											3
CO2	3		2											3
CO3	3		2											3

Text Books:

1. B.W Williams 'Power Electronics Circuit Devices and Applications'.
2. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, Third Edition, New Delhi, 2004
3. MD Singh and K.B Khanchandani, "Power Electronics", Tata McGraw Hill, 2001.

Reference Books:

4. Mohan, Undeland and Robins, "Power Electronics – Concepts, applications and Design, John Wiley and Sons, Singapore, 2000.
5. Joseph Vithayathil, Power Electronics: Principles and Applications, Delhi, Tata McGraw-Hill, 2010.

CONTROL STRATEGIES FOR POWER ELECTRONIC CONVERTERS

Subject Code: UGEE6H0222	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**1**	**-**	**4**

Course Objective:

This course introduces the various control strategies forthe different power electronic converters.

Syllabus

UNIT –I	**Control of DC-DC Converters**	**Hours: 08**
Current control and PWM voltage control techniques for Buck Regulator – Boost Regulator – Buck-Boost Regulator – Cuk Regulator – Comparison of Regulators – closed loop control techniques.		
UNIT –II	**Voltage Control of Single Phase Inverter**	**Hours: 08**
PWM – Single Pulse Width Modulation – Multiple Pulse Width Modulation – Sinusoidal Pulse Width Modulation – Modified Sinusoidal Pulse Width Modulation – Phase Displacement Control – Advanced Modulation Control Techniques.		
UNIT –III	**Voltage Control of Three Phase Inverter**	**Hours: 06**
Sinusoidal PWM – 60 Deg PWM – Third Harmonic PWM – Space Vector Modulation – Comparison of PWM techniques – Current Source Inverter – Variable DC link inverter.		
UNIT – IV	**Multilevel inverter**	**Hours: 06**
Diode Clamped Multilevel Inverter – Principle of operation – Features – Improved Diode Clamped Multilevel Inverter. Flying Capacitor Multilevel Inverter - Principle of operation – Features. Cascaded Multilevel Inverter - Principle of operation – Features and carrier PWM techinques.		
UNIT –V	**Power Factor Improvement**	**Hours: 08**
Extinction Angle Control – Symmetrical Angle Control – PWM control – Single Phase Sinusoidal PWM – Three Phase PWM Rectifier.		

Course Outcomes: At the end of this course students will be able to
CO1: Design and analyze the performance of DC-DC converters.
CO2: Acquire the knowledge about different types of Single phase PWM modulation strategies.
CO3: Acquire the knowledge about different types of Three phase PWM modulation strategies.
CO4: Design simulated models for the analysis of different topologies of multilevel inverter.
CO5: Understand the basics in PF improvement.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3		2											3
CO2	3		2											3
CO3	3		2											3
CO4	3		2											3
CO5	3		2											3

Text Books:

1. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint- 2008.
2. Power Electronics- Ned Mohan, Tore M.Undelan and William P.Robbins –John Wiley& Sons -2nd Edition.Power Electronics – Lander –Ed.2009.

Reference Books:

1. Modern power Electronics and AC Drives – B.K.Bose.

ELECTRIC DRIVES FOR ELECTRIC VEHICLES

Subject Code: UGEE7H0222	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**1**	**-**	**4**

Course Objective:

To impart knowledge about fundamentals of Electric drives and control, operational strategies of dc and ac motor drives and quadrant operations.

Syllabus

UNIT –I	**Chopper fed DC drive**	**Hours: 08**
Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripples, smooth starting.		
UNIT –II	**Multi-quadrant DC drive**	**Hours: 06**
Review of motoring and generating modes of operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers.		
UNIT –III	**Closed-loop control of DC Drive**	**Hours: 06**
Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – current controller specification and design, speed controller specification and design.		
UNIT –IV	**Scalar control or constant V/f control of induction motor**	**Hours: 10**
Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, and constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit.		
UNIT –V	**Control of slip ring induction motor**	**Hours: 08**
operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.		

Course Outcomes: At the end of this course students will be able to

CO1: Analyze the control and operation of DC motor fed by Chopper.

CO2: Examine the performance of Multi-quadrant DC drive.

CO3: Analyze the closed-loop control of DC drive.

CO4: Apply the knowledge of Three Phase VSI fed induction motor drive and analyze its performance for different modulation strategies.

CO5: Analyze the performance of slip ring induction motor control.

CO – PO Mapping

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	3	3											3
CO2	2		3											3
CO3			3											3
CO4	2		3											3
CO5	2	3	3											3

Text Books:

1. "Power Semiconductor Controlled Drives", G. K. Dubey, by Prentice Hall, 1989.
1. "Electric Motor Drives: Modeling, Analysis and Control", R. Krishnan, by Prentice Hall, 2001.
2. "Fundamentals of Electrical Drives", G. K. Dubey, by CRC Press, 2002.

Reference Books:

3. "Control of Electric Drives", W. Leonhard, by Springer Science & Business Media, 2001.