



Jawaharlal Nehru Technological University Anantapur

(Established by Govt. of A.P., Act. No. 30 of 2008)

Ananthapuramu–515 002 (A.P) India

Academic Regulations (R20) for B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic
Year **2020-2021** onwards)

and

Academic Regulations (R20) for B.Tech(Lateral Entry Scheme)

(Effective for the students getting admitted into II year through Lateral
Entry Scheme from the Academic Year **2021-2022** onwards)

1. Award of the Degree

a) Award of the B.Tech. Degree

A student will be declared eligible for the award of the B.Tech. degree if he/she fulfils the following:

- i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
- ii) Registers for 160 credits and secures all 160 credits.

b) Award of B.Tech. degree with Honours/Minor

A student will be declared eligible for the award of the B.Tech. with Honours/Minor if he/she fulfils the following:

- i) Student secures additional 20 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits
- ii) A student is permitted to register either for Honours or a Minor but not for both. Registering for Honours/Minor is optional.
- iii) Honours/Minor is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

3. Courses of study:

The following courses are offered at present as specializations for the B. Tech. program for non-autonomous, constituent & affiliated colleges from 20120-21

S. No.	Name of the Program	Program Code
1.	Civil Engineering	01
2.	Electrical and Electronics Engineering	02
3.	Mechanical Engineering	03
4.	Electronics and Communication Engineering	04
5.	Computer Science and Engineering	05
6.	Information Technology	12
7.	Food Technology	27
8.	Artificial Intelligence & Data Science	30
9.	Computer Science and Engineering (Artificial Intelligence)	31
10.	Computer Science and Engineering (Data Science)	32
11.	Computer Science and Engineering (Artificial Intelligence & Machine Learning)	33
12.	Computer Science and Engineering (IoT)	35

and any other course as approved by the authorities of the University from time to time.

4. Admissions:

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

5. Program related terms:

- a) **Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hrs. Practical (Lab) per week	1 credit

- b) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
- c) **Choice Based Credit System (CBCS):** The CBCS provides choice for students to select from the prescribed courses.

6. Structure of the Undergraduate Programme

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Code	Breakup of Credits (Total 160)
1.	Humanities and Social Science including Management courses	HS	10.5
2.	Basic Science courses	BS	21
3.	Engineering Science Courses	ES	24
4.	Professional Core Courses	PC	51
5.	Professional Elective Courses	PE	15
6.	Open Elective Courses	OE	12
7.	Skill Oriented Courses	SC	10
8.	Internship, Project work	PR	16.5
9.	Non-credit Mandatory Courses	MC	Non credit

7. Programme Pattern

- Total duration of the of B. Tech (Regular) Programme is four academic years
- Each academic year of study is divided into two semesters.
- Minimum number of instruction days in each semester is 90.
- There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to

Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.

- v. All undergraduate students shall register for NCC/NSS/ activities. A student will be required to participate in an activity for two hours in a week either in third or fourth semester. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet based on participation, attendance, performance, and behaviour. If a student gets an unsatisfactory grade, he/she shall repeat the above activity in the subsequent years, to complete the degree requirements
- vi. Courses like Environmental Sciences, Universal Human Values, Indian Constitution, Design Thinking for Innovation and Employability Skills is offered as non-credit mandatory courses for all branches.
- vii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.
- viii. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in an emerging area within the chosen field of study.
- ix. Student can opt for any open elective other than open elective offered by his/her own department. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to that of their departmental core/elective courses.
- x. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. 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/interdisciplinary courses and the other shall be a soft skills course.
- xi. Students shall undergo mandatory summer internships, for a minimum of six weeks duration at the end of second and third year of the programme. There shall also be mandatory full internship in the final semester of the programme along with the project work.
- xii. Undergraduate degree either with Honours or a Minor is introduced by the University for the students having good academic record
- xiii. Each college shall take measures to implement Virtual Labs (<https://www.vlab.co.in>) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.
- xiv. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration / career growth / placements / opportunities for higher studies / GATE / other competitive exams etc.
- xv. Preferably 25% course work for the theory courses in every semester shall be

conducted in the blended mode of learning.

8. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

- i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
- ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
- iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B)
- iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

a) Continuous Internal Evaluation

- i) For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper with 20 objective type questions (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.
- ii) Objective paper shall be set for maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type question. Each question carries 5 marks.

Note:

- The objective paper with 20 objective type questions shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted either online or offline by the respective institution on the day of subjective paper test.
- If conducted offline, the midterm examination shall be conducted first by distribution of the Objective paper, simultaneously marking the attendance, after 20 minutes the answered objective paper shall be collected back. The student is not allowed to leave the examination hall.
Then the descriptive question paper and the answer booklet shall be distributed. After 90minutes the answered booklets are collected back.
- The assignment shall contain numerical problems/software development. If subject is purely descriptive and does not have any numerical problems, then essay type question/term paper shall be given. It should be continuous assessment throughout the

semester. There shall be five assignments one for each unit and the average marks shall be considered.

- iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.
- iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.
- v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid: 25

Marks obtained in second mid: 20

Final mid semester Marks: $(25 \times 0.8) + (20 \times 0.2) = 24$

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

Marks obtained in first mid: Absent

Marks obtained in second mid: 25

Final mid semester Marks: $(25 \times 0.8) + (0 \times 0.2) = 20$

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

- i) There shall be 6 questions and all questions are compulsory.
- ii) Question I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.
- iii) There shall be 2 short answer questions from each unit.
- a) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for

Example: Basic Electrical & Electronics Engineering shall have the following pattern:

- i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
- ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.
- iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question

- b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the regularity/record/viva and 15 marks for the internal test. The end examination shall be conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 35 marks in each part. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

- c) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing is mentioned along with the syllabus.

- d) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks every six months/semester at a mutually convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.
- e) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

9. Skill oriented Courses

- i) There shall be five skill-oriented courses offered during III to VII semesters.
- ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
- f) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.
- iii) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.
- iv) 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 or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. 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.
- v) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the University at the beginning of the semester. The principal of the respective college shall forward such proposals to the University for approval.
- vi) 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 University.

10. Choice Based Credit Courses (CBCC):

There shall be five professional elective courses, four open elective courses and two humanities elective courses, which are Choice Based Credit Courses (CBCC), offered from III semester onwards. Among them, professional elective course offered in VI semester shall be pursued through MOOCs. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's assignment submissions given by SWAYAM/NPTEL. The student needs to earn a certificate by passing the exam. The student shall be

awarded the credits assigned in the curriculum only by submission of the certificate. In case, if student does not pass subject registered through SWAYAM/NPTEL, the University shall conduct the external examination for the MOOC subject for 100 marks based on the syllabi of the respective subject provided in the curriculum.

11. Mandatory Internships

Summer Internships:

Two summer internships either onsite or virtual each with a minimum of six weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Hydel and thermal power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The student shall register for the internship as per course structure after commencement of academic year.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate from industry shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages, respectively. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

Full Semester Internship and Project work:

In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report.

The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks based on Motivation, Technical Knowledge and Awareness related to the Project. At the end of the semester, it is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the University and is evaluated for 140 marks.

The College shall facilitate and monitor the student internship programs. Completion

of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

12. Guidelines for offering a Minor

The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. programme. 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 and as defined by the respective department offering Minor program. Minor in any other branch for improving knowledge and employability.

- i) Minor is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
- ii) Minor programs shall be offered in emerging technologies by the respective departments or in collaboration with the relevant industries/agencies.
- iii) 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 Undergraduate Degree in Major Discipline (i.e., 160 credits).
- iv) A student is permitted to register for a Minor offered by a department other than the parent department and as defined by the respective department offering Minor program.
- v) A student is permitted to register for Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
- vi) The courses offered under Minor can have theory as well as laboratory component. If a course comes with a lab component, that component is to be cleared separately
- vii) The Concerned Principal of the college shall arrange separate class work and timetable of the courses offered under various Minor programs.
- viii) Courses that are used to fulfil the student's primary major may not be double counted towards the Minor. Courses with content substantially equivalent to courses in the student's primary major may not be counted towards the Minor.
- ix) Students can complete the courses offered under Minor either in the college or in online platforms like SWAYAM / edX / Coursera / Udacity etc with a minimum duration of 12 weeks satisfying the criteria defined for credit mobility. If the courses under Minor are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses
- x) The attendance for the registered courses under Minor and regular courses offered for Major degree in a semester are to be considered separately.
- xi) A student shall maintain an attendance of 75% in all registered courses of Minor to be eligible for attending semester end examinations.

- xii) A student detained due to lack of attendance and having backlogs in regular B. Tech program shall not be permitted to continue Minor
- xiii) A student registered for Minor in a discipline shall pass in all subjects that constitute the requirement for the Minor degree programme. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Minor degree programme.
- xiv) If a student drops or is terminated from the Minor program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- xv) The Minor in a discipline will be mentioned in the degree certificate as Bachelor of Technology in XXX with Minor in YYY. For example, Bachelor of Technology in Mechanical Engineering with Minor in Machine Learning.

Enrolment into a Minor:

- i) The enrolment of student into a Minor is based on the CGPA obtained in the major degree program.
- ii) CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having a CGPA of 7.5 (for SC/ST students CGPA of 7.0) without any backlog subjects will be permitted to register for a Minor.
- iii) For applicability of Minor, a student shall pass all the courses in the subsequent semesters of regular B.Tech program without any backlogs otherwise registration for Minor shall be cancelled. In such case, student will receive B.Tech. degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- iv) If a student is detained due to lack of attendance in either Major or Minor program, registration shall be cancelled
- v) Minimum strength required for offering a Minor offline in a discipline is considered as 20% of the sanctioned intake. 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 satisfying the criteria for credit mobility.
- vi) Transfer of credits from a particular Minor to regular B. Tech. and vice-versa shall not be permitted
- vii) Minor is to be completed simultaneously with Major degree program.

Registration for Minor:

- i) The institution will announce specialization, eligibility and courses offered by the departments under Minor and seek registrations in IV Semester, after the results of III Semester are announced.
- ii) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week

before the start of every semester. Selected students shall be permitted to register the courses under Minor.

- iii) The selected students shall submit their willingness to the principal through his/her parent department which shall be forwarded to the concerned departments offering Minor. Both parent department and department offering minor shall maintain the record of student pursuing the Minor.
- iv) The students enrolled in the minor courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.
- v) There is no fee for registration of subjects under Minor program offered in offline at the respective institutions.

13. Guidelines for offering Honours

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

- i) Honours is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
- ii) A student shall earn additional 20 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).
- iii) A student is permitted to register for Honours in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honours from V Semester onwards.
- iv) The Concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honours program.
- v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honours. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honours.
- vi) Students can complete the courses offered under Honours either in the college or in online platforms like SWAYAM/ edX / Coursera / Udacity etc with a minimum duration of 12 weeks satisfying the criteria for credit mobility. If the courses under Honours are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses
- vii) The attendance for the registered courses under Honours and regular courses offered for Major degree in a semester are to be considered separately.
- viii) A student shall maintain an attendance of 75% in all registered courses under Honours to be eligible for attending semester end examinations.
- ix) A student detained due to lack of attendance and having backlogs in regular B.

Tech program shall not be permitted to continue Honours

- x) A student registered for Honours shall pass in all subjects that constitute the requirement for the Honours degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honours degree programme.
- xi) If a student drops or is terminated from the Honours program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- xii) The Honours will be mentioned in the degree certificate as Bachelor of Technology (Honours) in XXX. For example, B.Tech. (Honours) in Mechanical Engineering

Enrolment into Honours:

- i) Students of a Department/Discipline are eligible to opt for Honours program offered by the same Department/Discipline
- ii) The enrolment of student into Honours is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having a CGPA of 8 (for SC/ST students CGPA of 7.5) without any backlog subjects will be permitted to register for Honours.
- iii) For applicability of Honours, a student shall pass all the courses in the subsequent semesters of regular B.Tech program without any backlogs otherwise registration for Honours shall be cancelled. In such case, student will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them
- iv) If a student is detained due to lack of attendance either in Major or in Honours, registration shall be cancelled
- v) Minimum strength required for offering Honours offline is considered as 20% of the sanctioned intake. 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 satisfying criteria for credit mobility.
- vi) Transfer of credits from Honours to regular B. Tech degree and vice-versa shall not be permitted
- vii) Honours is to be completed simultaneously with a Major degree program.

Registration for Honours:

- i) The institution will announce courses offered by the departments under Honours before the start of the semester.
- ii) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to

register the courses under Honours.

- iii) The selected students shall submit their willingness to the Principal through his/her parent department offering Honours. The parent department shall maintain the record of student pursuing the Honours.
- iv) The students enrolled in the Honours courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.
- v) There is no fee for registration of subjects for Honours program offered in offline at the respective institutions.

14. Attendance Requirements:

- i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
- ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
- iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.
- iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
- vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
- vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.
- viii) For induction programme attendance shall be maintained as per AICTE norms.

15. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 14.

- i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.
- ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any **decimal** fraction should be **rounded off to lower** digit) up to in the subjects that have been studied up to III semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

One regular and two supplementary examinations of I Semester

One regular and one supplementary examination of II Semester

One regular examination of III semester

- iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any **decimal** fraction should be **rounded off to lower** digit) in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

One regular and four supplementary examinations of I Semester.

One regular and three supplementary examinations of II Semester.

One regular and two supplementary examinations of III Semester.

One regular and one supplementary examination of IV Semester.

One regular examination of V Semester.

And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

- iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

16. With-holding of Results

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

17. Award of Grades:

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned
≥ 90	S (Superior)	10
$\geq 80 < 90$	A (Excellent)	9
$\geq 70 < 80$	B (Very Good)	8
$\geq 60 < 70$	C (Good)	7
$\geq 50 < 60$	D (Average)	6
$\geq 40 < 50$	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

- i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

- ii) For mandatory courses, “Satisfactory” or “Unsatisfactory” shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

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

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

$$\text{SGPA} = \Sigma (C_i \times G_i) / \Sigma C_i$$

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.

- ii) 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.,

$$\text{CGPA} = \Sigma (C_i \times S_i) / \Sigma C_i$$

where “ S_i ” is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester.

- iii) Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- iv) While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

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

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

18. Gap Year Concept

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The Principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not.

19. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who

have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

20. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each semester shall be 90 days.

21. Medium of Instruction:

The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in English only.

22. Student Transfers:

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

23. General Instructions:

- a. The academic regulations should be read as a whole for purpose of any interpretation.
- b. Malpractices rules-nature and punishments are appended.
- c. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
- d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- e. The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.

**ACADEMIC REGULATIONS (R20)
FOR B.TECH (LATERAL ENTRY SCHEME)**

*(Effective for the students getting admitted into II year through Lateral Entry Scheme
from the Academic Year 2021-2022 onwards)*

1. Award of B.Tech. Degree

A student admitted in Lateral Entry Scheme (LES) will be declared eligible for the award of the B.Tech degree if the student fulfils the following academic regulations:

- a) Pursues a course of study for not less than three academic years and not more than six academic years.
 - b) Registers for 121 credits and secures all 121 credits from II to IV year of Regular B. Tech. program.
- 2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.**

3. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.4

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.
- ii. A student shall be promoted from third year to fourth year only if the student fulfils the academic requirements of securing 40% of credits (any **decimal** fraction should be **rounded off to lower** digit) from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.
 - a. One regular and two supplementary examinations of III semester.
 - b. One regular and one supplementary examination of IV semester.
 - c. One regular examination of V semester.

And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

- 4.1. The entire course of study is three academic years on semester pattern.
 - 4.2. A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
 - 4.3. When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.
5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
 6. There shall be a bridge course in Mathematics with zero credits in III semester for all disciplines. The course work is conducted for 20 Hrs in the semester and there shall be no examination conducted for the course. However, attendance is mandatory and shall be considered while calculating aggregate attendance.
 5. Lateral Entry Students shall compulsorily pursue mandatory non-credit courses Environmental Science and Universal Human Values either in III semester or IV semester.

RULES FOR

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

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

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

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

Malpractices identified by squad or special invigilators

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

Note:-

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfil all the norms required for the award of Degree.



Jawaharlal Nehru Technological University Anantapur

(Established by Govt. of A.P., Act. No. 30 of 2008)

Ananthapuramu-515 002 (A.P) India

First Year B.Tech Course Structures and Syllabi under R20 Regulations



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTAPUR – 515 002 (A.P) INDIA

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Semester-0

Induction Program: 3 weeks
(Common for All Branches of Engineering)

S.No	Course No	Course Name	Category	L-T-P-C
1		Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2		Career Counselling	MC	2-0-2-0
3		Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4		Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5		Proficiency Modules & Productivity Tools	ES	2-1-2-0
6		Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7		Remedial Training in Foundation Courses	MC	2-1-2-0
8		Human Values & Professional Ethics	MC	3-0-0-0
9		Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10		Concepts of Programming	ES	2-0-2-0



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Electrical & Electronics Engineering

Semester - 1 (Theory - 5, Lab - 4)

S.No	Course No	Course Name	Category	L-T-P/D	Credits
1.	20A54101	Linear Algebra and Calculus	BS	3-0-0	3
2.	20A56201T	Applied Physics	BS	3-0-0	3
3.	20A52101T	Communicative English	HS	3-0-0	3
4.	20A02101T	Fundamentals of Electrical Circuits	ES	3-0-0	3
5.	20A03101T	Engineering Drawing	ES	1-0-0/2	2
6.	20A03101P	Engineering Graphics Lab	ES	0-0-2	1
7.	20A56201P	Applied Physics Lab	BS	0-0-3	1.5
8.	20A52101P	Communicative English Lab	HS	0-0-3	1.5
9.	20A02101P	Fundamentals of Electrical Circuits Lab	ES	0-0-2	1.5
Total					19.5

Semester – 2 (Theory – 5, Lab – 5)

S.No	Course No	Course Name	Category	L-T-P	Credits
1.	20A54201	Differential Equations and Vector Calculus	BS	3-0-0	3
2.	20A51101T	Chemistry	BS	3-0-0	3
3.	20A05201T	C-Programming & Data Structures	ES	3-0-0	3
4.	20A04101T	Electronic Devices & Circuits	ES	3-0-0	3
5.	20A03202	Engineering Workshop	LC	0-0-3	1.5
6.	20A05202	IT Workshop	LC	0-0-3	1.5
7.	20A05201P	C-Programming & Data Structures Lab	ES	0-0-3	1.5
8.	20A51101P	Chemistry Lab	BS	0-0-3	1.5
9.	20A04101P	Electronic Devices & Circuits Lab	ES	0-0-3	1.5
10.	20A99201	Environmental Science	MC	3-0-0	0.0
Total					19.5

(20A54101) LINEAR ALGEBRA & CALCULUS
(Common to All Branches of Engineering)

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

UNIT -1

Matrices

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.

Learning Outcomes:

At the end of this unit, the student will be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (L3)

UNIT -2

Mean Value Theorems

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT -3

Multivariable Calculus

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT -4**Multiple Integrals**

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

Learning Outcomes:

At the end of this unit, the student will be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)
- Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries (L5)

UNIT -5**Beta and Gamma functions**

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
4. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. Dean G. Duffy, Advanced Engineering Mathematics with MATLAB, CRC Press
6. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
7. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
8. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education

9. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
10. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Course Outcomes:

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

- Develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- Utilize mean value theorems to real life problems (L3)
- Familiarize with functions of several variables which is useful in optimization (L3)
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems (L5)
- Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

20A56201T APPLIED PHYSICS

(ECE, EEE, CSE, AI & DS, CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT)

Course Objectives

- To make a bridge between the physics in school and engineering courses.
- To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications
- To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To enlighten the concepts of Quantum Mechanics and to provide fundamentals of de'Broglie waves, quantum mechanical wave equation and its applications, the importance of free electron theory and band theory of solids.
- Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of charge carriers in semiconductors. To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications.

Unit-I:

Wave Optics

Interference- Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Grating spectrum.

Polarization- Introduction – Types of polarization – Polarization by reflection, refraction and double refraction - Nicol's Prism - Half wave and Quarter wave plates with applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the need of coherent sources and the conditions for sustained interference (L2)
- Identify engineering applications of interference (L3)
- Analyze the differences between interference and diffraction with applications (L4)
- Illustrate the concept of polarization of light and its applications (L2)
- Classify ordinary polarized light and extraordinary polarized light (L2)

Unit-II:

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (qualitative) – Applications.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

Unit-III:

Dielectric and Magnetic Materials

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius-Mosotti relation in dielectrics (L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)
- Apply the concept of magnetism to magnetic devices (L3)

Unit IV:

Quantum Mechanics, Free Electron Theory and Band theory of Solids

Quantum Mechanics- Dual nature of matter – Schrodinger's time independent and dependent wave equation – Significance of wave function – Particle in a one-dimensional infinite potential well.

Free Electron Theory- Classical free electron theory (Merits and demerits only) – Quantum free electron theory – Equation for electrical conductivity based on quantum free electron theory – Fermi-Dirac distribution – Density of states – Fermi energy.

Band theory of Solids- Bloch's Theorem (Qualitative) – Kronig-Penney model (Qualitative) – E vs K diagram – Classification of crystalline solids – Effective mass of electron – m^* vs K diagram – Concept of hole.

Learning Outcomes:

At the end of this unit, the student will be able to

- Explain the concept of dual nature of matter (L2)
- Understand the significance of wave function (L2)
- Interpret the concepts of classical and quantum free electron theories (L2)
- Explain the importance of K-P model
- Classify the materials based on band theory (L2)
- Apply the concept of effective mass of electron (L3)

Unit – V:

Semiconductors and Superconductors

Semiconductors- Introduction – Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors – Density of charge carriers – Dependence of Fermi energy on carrier concentration and temperature – Drift and diffusion currents – Einstein's equation – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applications of Hall effect.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) – High T_c superconductors – Applications of superconductors.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)
- Explain how electrical resistivity of solids changes with temperature (L2)
- Classify superconductors based on Meissner's effect (L2)
- Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics – B.K. Pandey and S. Chaturvedi, Cengage Learning.

Reference Books:

1. Engineering Physics – Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
4. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill

Course Outcomes

- Study the different realms of physics and their applications in both scientific and technological systems through physical optics. (L2)
- Identify the wave properties of light and the interaction of energy with the matter (L3).
- Asses the electromagnetic wave propagation and its power in different media (L5).
- Understands the response of dielectric and magnetic materials to the applied electric and magnetic fields. (L3)
- Study the quantum mechanical picture of subatomic world along with the discrepancies between the classical estimates and laboratory observations of electron transportation phenomena by free electron theory and band theory. (L2)
- Elaborate the physical properties exhibited by materials through the understanding of properties of semiconductors and superconductors. (L5)

(20A52101T) COMMUNICATIVE ENGLISH
(Common to All Branches of Engineering)

Course Objectives

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

UNIT -1

Lesson: On the Conduct of Life: William Hazlitt

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Reading for Writing : Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Learning Outcomes

At the end of the module, the learners will be able to

- Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- Ask and answer general questions on familiar topics and introduce oneself/others
- Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- Form sentences using proper grammatical structures and correct word forms

UNIT -2

Lesson: The Brook: Alfred Tennyson

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas

in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Learning Outcomes

At the end of the module, the learners will be able to

- Comprehend short talks on general topics
- Participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- Understand the use of cohesive devices for better reading comprehension
- Write well structured paragraphs on specific topics
- Identify basic errors of grammar/ usage and make necessary corrections in short texts

UNIT -3

Lesson: The Death Trap: Saki

Listening: Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing, Paragraph Writing **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Learning Outcomes

At the end of the module, the learners will be able to

- Comprehend short talks and summarize the content with clarity and precision
- Participate in informal discussions and report what is discussed
- Infer meanings of unfamiliar words using contextual clues
- Write summaries based on global comprehension of reading/listening texts
- Use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

UNIT-4

Lesson: Innovation: Muhammad Yunus

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Letter Writing: Official Letters/Report Writing **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice

Learning Outcomes

At the end of the module, the learners will be able to

- Infer and predict about content of spoken discourse
- Understand verbal and non-verbal features of communication and hold formal/informal conversations
- Interpret graphic elements used in academic texts
- Produce a coherent paragraph interpreting a figure/graph/chart/table
- Use language appropriate for description and interpretation of graphical elements

UNIT -5

Lesson: Politics and the English Language: George Orwell

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Reading: Reading for comprehension. Writing: Writing structured essays on specific topics using suitable claims and evidences. Grammar and Vocabulary: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Learning Outcomes

At the end of the module, the learners will be able to

- Take notes while listening to a talk/lecture and make use of them to answer questions
- Make formal oral presentations using effective strategies
- Comprehend, discuss and respond to academic texts orally and in writing
- Produce a well-organized essay with adequate support and detail
- Edit short texts by correcting common errors

Text Book:

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

Course Outcomes

- Retrieve the knowledge of basic grammatical concepts
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
- Create a coherent paragraph interpreting a figure/graph/chart/table

Web links

www.englishclub.com

www.easyworldofenglish.com

www.languageguide.org/english/

www.bbc.co.uk/learningenglish

www.eslpod.com/index.html

www.myenglishpages.com

(20A02101T) FUNDAMENTALS OF ELECTRICAL CIRCUITS

Course Objectives:

To make the student learn about

- Basic characteristics of R, L, C parameters, their Voltage and Current Relations and Various combinations of these parameters.
- The Single Phase AC circuits and concepts of real power, reactive power, complex power, phase angle and phase difference
- Series and parallel resonances, bandwidth, current locus diagrams
- Network theorems and their applications
- Network Topology and concepts like Tree, Cut-set , Tie-set, Loop, Co-Tree

Unit- 1

Introduction to Electrical & Magnetic Circuits

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage - Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques- Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation. Examples

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about Kirchhoff's Laws in solving series, parallel, non-series-parallel configurations in DC networks
- To know about voltage source to current source and vice-versa transformation in their representation
- To understand Faraday's laws
- To distinguish analogy between electric and magnetic circuits
- To understand analysis of series and parallel magnetic circuits

Unit- 2

Network Topology

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis.

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand basic graph theory definitions which are required for solving electrical circuits
- To understand about loop current method

- To understand about nodal analysis methods
- To understand about principle of duality and dual networks
- To identify the solution methodology in solving electrical circuits based on the topology

Unit- 3

Single Phase A.C Circuits

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation- Resonance - Phasor diagrams - Concept of Power Factor- Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.

Learning Outcomes:

At the end of this unit, the student will be able to

- To understand fundamental definitions of 1- ϕ AC circuits
- To distinguish between scalar, vector and phasor quantities
- To understand voltage, current and power relationships in 1- ϕ AC circuits with basic elements R, L, and C.
- To understand the basic definitions of complex immittances and complex power
- To solve 1- ϕ AC circuits with series and parallel combinations of electrical circuit elements R, L and C.

Unit- 4

Network Theorems

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millmann's, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know that electrical circuits are 'heart' of electrical engineering subjects and network theorems are main part of it.
- To distinguish between various theorems and inter-relationship between various theorems
- To know about applications of certain theorems to DC circuit analysis
- To know about applications of certain theorems to AC network analysis
- To know about applications of certain theorems to both DC and AC network analysis

Unit- 5

Three Phase A.C. Circuits

Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Star Delta Transformation Technique – for balanced and unbalanced circuits - Measurement of Active and reactive Power – Advantages of Three Phase System.

Learning Outcomes:

At the end of this unit, the student will be able to

- To know about advantages of 3- ϕ circuits over 1- ϕ circuits
- To distinguish between balanced and unbalanced circuits
- To know about phasor relationships of voltage, current, power in star and delta connected balanced and unbalanced loads
- To know about measurement of active, reactive powers in balanced circuits
- To understand about analysis of unbalanced circuits and power calculations

Text Books:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.

Reference Books:

1. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.
2. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
3. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
4. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
5. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

Course Outcomes:

After completing the course, the student should be able to do the following

- Given a network, find the equivalent impedance by using network reduction techniques and determine the current through any element and voltage across and power through any element.
- Given a circuit and the excitation, determine the real power, reactive power, power factor etc.,
- Apply the network theorems suitably
- Determine the Dual of the Network, develop the Cut Set and Tie-set Matrices for a given Circuit. Also understand various basic definitions and concepts.

(20A03101T) ENGINEERING DRAWING
(Common to All Branches of Engineering)

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.

Unit: I

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance- Conventions in drawing-lettering - BIS conventions.

- a) Conic sections including the rectangular hyperbola- general method only,
- b) Cycloid, epicycloids and hypocycloid c) Involute

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the significance of engineering drawing
- Know the conventions used in the engineering drawing
- Identify the curves obtained in different conic sections
- Draw different curves such as cycloid, involute and hyperbola

Unit: II

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the meaning of projection
- Know how to draw the projections of points, lines
- Differentiate between projected length and true length
- Find the true length of the lines

Unit: III

Projections of solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the procedure to draw projection of solids
- Differentiate between rotational method and auxillary view method.
- Draw the projection of solid inclined to one plain
- Draw the projection of solids inclined to both the plains

Unit: IV

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand different sectional views of regular solids
- Obtain the true shapes of the sections of prism
- Draw the sectional views of prism, cylinder, pyramid and cone

Unit: V

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

Learning Outcomes:

At the end of this unit the student will be able to

- Understand the meaning of development of surfaces
- Draw the development of regular solids such as prism, cylinder, pyramid and cone
- Obtain the development of sectional parts of regular shapes

Text Books:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

After completing the course, the student will be able to

- Draw various curves applied in engineering. (12)
- Show projections of solids and sections graphically. (12)
- Draw the development of surfaces of solids. (13)

Additional Sources

Youtube: <http://sewor.Carleton.ca/gkardos/88403/drawings.html> conic sections-online, red woods.edu

(20A03101P)Engineering Graphics Lab
(Common to all Engineering Branches)

Course Objectives:

- Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling.
- Instruct graphical representation of machine components.

Computer Aided Drafting:

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions.

Dimensioning principles and conventional representations.

Orthographic Projections: Systems of projections, conventions and application to orthographic projections - simple objects.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Text Books:

1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

Reference Books:

1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

After completing the course, the student will be able to

- Use computers as a drafting tool. (L2)
- Draw isometric and orthographic drawings using CAD packages. (L3)

Additional Sources

1. Youtube: [http://sewor,Carleton.ca, kardos/88403/drawings.html](http://sewor.Carleton.ca/kardos/88403/drawings.html) conic sections-online, red woods.edu

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (EEE)– I Sem

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(20A56201P) APPLIED PHYSICS LAB

(ECE, EEE, CSE, AI & DS, CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT)

Course Objectives:

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

Note: In the following list, out of 15 experiments, any 12 experiments (minimum 10) must be performed in a semester

List of Applied Physics Experiments

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of dispersive power of prism.
5. Determination of wavelength of LASER light using diffraction grating.
6. Determination of particle size using LASER.
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
8. Determination of dielectric constant by charging and discharging method.
9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
10. Measurement of magnetic susceptibility by Gouy's method
11. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
12. To determine the resistivity of semiconductor by Four probe method
13. To determine the energy gap of a semiconductor
14. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
15. Measurement of resistance with varying temperature.

Course Outcomes:

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

- Operate optical instruments like microscope and spectrometer (L2)
- Determine thickness of a hair/paper with the concept of interference (L2)
- Estimate the wavelength of different colors using diffraction grating and resolving power (L2)
- Plot the intensity of the magnetic field of circular coil carrying current with distance (L3)
- Evaluate the acceptance angle of an optical fiber and numerical aperture (L3)
- Determine the resistivity of the given semiconductor using four probe method (L3)
- Identify the type of semiconductor i.e., n-type or p-type using hall effect (L3)
- Calculate the band gap of a given semiconductor (L3)

References

1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers, 2017.
2. <http://vlab.amrita.edu/index.php> -Virtual Labs, Amrita University

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (EEE)– I Sem

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(20A52101P) COMMUNICATIVE ENGLISH LAB
(Common to All Branches of Engineering)

Course Objectives

- students will be exposed to a variety of self instructional, learner friendly modes of language learning
- students will learn better pronunciation through stress, intonation and rhythm
- students will be trained to use language effectively to face interviews, group discussions, public speaking
- students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

List of Topics

1. Phonetics
2. Reading comprehension
3. Describing objects/places/persons
4. Role Play or Conversational Practice
5. JAM
6. Etiquettes of Telephonic Communication
7. Information Transfer
8. Note Making and Note Taking
9. E-mail Writing
10. Group Discussions-1
11. Resume Writing
12. Debates
13. Oral Presentations
14. Poster Presentation
15. Interviews Skills-1

Suggested Software

Orel, Walden Infotech, Young India Films

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links

www.esl-lab.com
www.englishmedialab.com
www.englishinteractive.net

Course Outcomes

After completing the course, the student will be able to

- Listening and repeating the sounds of English Language
- Understand the different aspects of the English language
- proficiency with emphasis on LSRW skills
- Apply communication skills through various language learning activities
- Analyze the English speech sounds, stress, rhythm, intonation and syllable
- Division for better listening and speaking comprehension.
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it in order to
- Improve fluency in spoken English.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (EEE)– I Sem

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(20A02101P) FUNDAMENTALS OF ELECTRICAL CIRCUITS LAB

Course Objectives:

- Remember, understand and apply various theorems and verify practically.
- Understand and analyze active, reactive power measurements in three phase balanced & unbalanced circuits.

List of Experiments:

1. Verification of Thevenin's and Norton's Theorems
2. Verification of Superposition Theorem for average and rms values
3. Maximum Power Transfer Theorem for DC and AC circuits
4. Verification of Compensation Theorem for DC circuits
5. Verification of Reciprocity, Millmann's Theorems for DC circuits
6. Determination of Self, Mutual Inductances and Coefficient of Coupling
7. Measurement of Active Power for Star Connected Balanced Loads
8. Measurement of Reactive Power for Star Connected Balanced Loads
9. Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads
10. Measurement of Active Power for Delta Connected Balanced Loads
11. Measurement of Reactive Power for Delta Connected Balanced Loads

Course Outcomes:

At the end of the course, students should be able to

- Remember, understand and apply various theorems and verify practically.
- Understand and analyze active, reactive power measurements in three phase balanced & unbalanced circuits.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (EEE)– II Sem

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(20A54201) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to Civil, EEE, Mechanical, ECE and Food Technology)

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

UNIT -1

Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the essential characteristics of linear differential equations with constant coefficients (L3)
- Solve the linear differential equations with constant coefficients by appropriate method (L3)
- Classify and interpret the solutions of linear differential equations (L3)
- Formulate and solve the higher order differential equation by analyzing physical situations (L3)

UNIT 2:

Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply a range of techniques to find solutions of standard pdes (L3)
- Outline the basic properties of standard PDEs (L2)

UNIT -3

Applications of Partial Differential Equations

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Classify the PDE (L3)
- Learn the applications of PDEs (L2)

UNIT-4

Vector differentiation

Scalar and vector point functions, vector operator ∇ , ∇ applies to scalar point functions-Gradient, ∇ applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply ∇ to Scalar and vector point functions (L3)
- Illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT -5

Vector integration

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Find the work done in moving a particle along the path over a force field (L4)
- Evaluate the rates of fluid flow along and across curves (L4)
- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
6. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
7. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
8. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
9. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I & II, Pearson Education
10. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.
11. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
12. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Course Outcomes:

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

- Solve the differential equations related to various engineering fields (L6)
- Identify solution methods for partial differential equations that model physical processes (L3)
- Interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- Estimate the work done against a field, circulation and flux using vector calculus (L6)

(20A51101T) CHEMISTRY

(CSE, AI & DS, CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT, ECE, EEE and IT)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches

Unit 1: Structure and Bonding Models:

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2 , applications to hydrogen, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO , etc. π -molecular orbitals of butadiene and benzene, calculation of bond order.

Learning Outcomes:

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

- Apply Schrodinger wave equation to hydrogen atom (L3)
- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Explain the calculation of bond order of O_2 and CO molecules (L2)
- Discuss the basic concept of molecular orbital theory (L3)

Unit 2: Modern Engineering materials:

Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic and colour.

Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.

Supercapacitors: Introduction, Basic concept-Classification – Applications.

Nanochemistry: Introduction, classification of nanomaterials, properties and applications of Fullerenes, carbon nano tubes and Graphenes nanoparticles.

Learning Outcomes:

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

- Explain splitting in octahedral and tetrahedral geometry of complexes (L2).
- Discuss the magnetic behaviour and colour of coordination compounds (L3).
- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nano tubes and Graphenes nanoparticles (L2).

Unit 3: Electrochemistry and Applications:

Electrodes – concepts, reference electrodes (Calomel electrode, $Ag/AgCl$ electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems,

potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad), and lithium ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

Learning Outcomes:

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

- Apply Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between pH metry, potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)
- Solve problems based on cell potential (L3)

Unit 4: Polymer Chemistry:

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

Learning Outcomes:

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

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylon-6,6, and carbon fibres (L2)
- Describe the mechanism of conduction in conducting polymers (L2)
- Discuss Buna-S and Buna-N elastomers and their applications (L2)

Unit 5: Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Principle and applications of pH metry, UV-Visible, IR Spectroscopies. Solid-Liquid Chromatography–TLC, retention time.

Learning outcomes:

After completion of Unit IV, students will be able to:

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles of different analytical instruments (L2)
- Explain the different applications of analytical instruments (L2)

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
4. J.M.Lehn, Supra Molecular Chemistry, VCH Publications

Course Outcomes:

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

- Compare the materials of construction for battery and electrochemical sensors (I2)
- Explain the preparation, properties, and applications of thermoplastics & thermosetting, elastomers & conducting polymers. (I2)
- Explain the principles of spectrometry, slc in separation of solid and liquid mixtures (I2)
- Apply the principle of Band diagrams in application of conductors and semiconductors (L3)

(20A05201T) C-PROGRAMMING & DATA STRUCTURES
(Common to All Branches of Engineering)

Course Objectives:

- To illustrate the basic concepts of C programming language.
- To discuss the concepts of Functions, Arrays, Pointers and Structures.
- To familiarize with Stack, Queue and Linked lists data structures.
- To explain the concepts of non-linear data structures like graphs and trees.
- To learn different types of searching and sorting techniques.

UNIT-1

Introduction to C Language - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays.

Learning outcomes:

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

- Use C basic concepts to write simple C programs. (L3)
- Use iterative statements for writing the C programs (L3)
- Use arrays to process multiple homogeneous data. (L3)
- Test and execute the programs and correct syntax and logical errors. (L4)
- Translate algorithms into programs. (L4)
- Implement conditional branching, iteration and recursion. (L2)

UNIT – 2

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, Strings, string handling functions, and Command line arguments.

Learning outcomes:

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

- Writing structured programs using C Functions. (L5)
- Writing C programs using various storage classes to control variable access. (L5)
- Apply String handling functions and pointers. (L3)
- Use arrays, pointers and structures to formulate algorithms and write programs.(L3)

UNIT-3

Data Structures, Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

Learning outcomes:

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

- Describe the operations of Stack. (L2)
- Explain the different notations of arithmetic expression. (L5)
- Develop various operations on Queues. (L6)

UNIT – 4

Linked Lists – Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

Learning outcomes:

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

- Analyze various operations on singly linked list. (L4)
- Interpret operations of doubly linked lists. (L2)
- Apply various operations on Circular linked lists. (L6)

UNIT-5

Trees - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

Learning outcomes:

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

- Develop the representation of Tress. (L3)
- Identify the various Binary tree traversals. (L3)
- Illustrate different Graph traversals like BFS and DFS. (L2)
- Design the different sorting techniques (L6)
- Apply programming to solve searching and sorting problems. (L3)

Text Books:

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
4. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T. Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Course Outcomes:

1. Analyse the basic concepts of C Programming language. (L4)
2. Design applications in C, using functions, arrays, pointers and structures. (L6)
3. Apply the concepts of Stacks and Queues in solving the problems. (L3)
4. Explore various operations on Linked lists. (L5)
5. Demonstrate various tree traversals and graph traversal techniques. (L2)
6. Design searching and sorting methods (L3)

(20A04101T) Electronic Devices & Circuits
(Common to EEE and ECE)

Course Objectives:

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Unit – 1

Review of Semiconductors: Intrinsic semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction with Open Circuit, PN Junction with Applied Voltage, Capacitive Effects in PN Junction.

Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias, reverse bias, and breakdown regions, Modeling the Diode Forward Characteristics- exponential model, graphical analysis and Iterative analysis using the exponential model, constant voltage drop model, the small signal model.

Learning outcomes:

- Remember and understand the basic characteristics of semiconductor diode (L1)
- Understand iterative and graphical analysis of simple diode circuits (L1)

Unit – 2

Zener Diodes– Zener diode Characteristics, Voltage shunt regulator, Temperature Effects, Rectifier Circuits– half-wave, full-wave and bridge rectifier circuits, rectifier with a filter capacitor, C-L-C filter, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottky barrier diode, Varactor diode, photo diode, light emitting diode(LED), Problem Solving.

Bipolar Junction Transistors(BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, and saturation modes, V-I Characteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect.

Learning outcomes:

- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Understand the V-I characteristics of BJT and its different configurations (L1)
- Analyze various applications of diode and special purpose diodes (L3)
- Design rectifier and voltage regulator circuits (L4)

Unit- 3

BJT circuits at DC, Applying the BJT in Amplifier Design- Voltage Amplifier, Voltage Transfer Characteristic (VTC), Small-Signal Voltage Gain, determining the VTC by Graphical Analysis, Q-

point, Small-signal operation and models- the transconductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid- π Model, the T Model, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Biasing in BJT Amplifier Circuits- Fixed bias, Self bias, voltage divider bias circuits, biasing using a Constant-Current Source, CE amplifier – Small signal analysis and design, Transistor breakdown and Temperature Effects, Problem solving.

Learning outcomes:

- Solve problems on various biasing circuits using BJT (L2)
- Analyze BJT based biasing circuits (L3)
- Design an amplifier using BJT based on the given specifications (L4)

Unit – 4

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET, CMOS, V-I characteristics – $i_D - v_{DS}$ characteristics, $i_D - v_{GS}$ characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point. Problem solving.

Learning outcomes:

- Understand principle of operation of various types of MOSFET devices (L1)
- Understand the V-I characteristics of MOSFET devices and their configurations (L1)

Unit – 5

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source (CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response, Biasing in MOSFET Amplifier Circuits– biasing by fixing V_{GS} with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, Common Source Amplifier using MOSFETs – Small signal analysis and design, Body Effect, Problem Solving.

Learning outcomes:

- Solve problems on small signal equivalent of MOSFET devices (L2)
- Analyze various biasing circuits based on different types of MOSFETs (L3)
- Design an amplifier using BJT based on the given specifications (L4)

Text Books:

1. Adel S. Sedra and Kenneth C. Smith, “Microelectronic Circuits – Theory and Applications”, 6th Edition, Oxford Press, 2013.
2. Donald A Neamen, “Electronic Circuits – analysis and design”, 3rd Edition, McGraw Hill (India), 2019.

References:

1. J. Milliman and C Halkias, "Integrated electronics", 2nd Edition, Tata McGraw Hill, 1991.
2. Behzad Razavi, "Microelectronics", Second edition, Wiley, 2013.
3. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits," 9th Edition, Pearson, 2006.
1. Jimmie J Cathey, "Electronic Devices and Circuits," Schaum's outlines series, 3rd edition, McGraw-Hill (India), 2010.

Course Outcomes:

After the completion of the course students will able to

- CO1:** Understand principle of operation, characteristics and applications of Semiconductor diodes, Bipolar Junction Transistor and MOSFETs.
- CO2:** Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.
- CO3:** Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.
- CO4:** Design of diode circuits and amplifiers using BJTs, and MOSFETs.
- CO5:** Compare the performance of various semiconductor devices.

(20A03202) ENGINEERING WORKSHOP
(Common to All Branches of Engineering)

Course Objective:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

List of Topics

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

- a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

- a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

- a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two wheeler tyre

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections

- a) Parallel and series b) Two way switch c) Godown lighting
d) Tube light e) Three phase motor f) Soldering of wires

Course Outcomes:

After completion of this lab the student will be able to

- Apply wood working skills in real world applications. (I3)
- Build different objects with metal sheets in real world applications. (I3)
- Apply fitting operations in various applications. (I3)
- Apply different types of basic electric circuit connections. (I3)
- Use soldering and brazing techniques. (I2)

Note: In each section a minimum of three exercises are to be carried out.

(20A05202) IT WORKSHOP
(Common to All Branches of Engineering)

Course Objectives:

- To make the students know about the internal parts of a computer, assembling and disassembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations and LAtEX
- To learn about Networking of computers and use Internet facility for Browsing and Searching

Preparing your Computer

Task 1:

Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2:

Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods

Task 3:

Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4:

Operating system features: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and Internet

Task 5:

Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimping activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

Task 7:

Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

Productivity tools

Task 8:

Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

Task 9:

Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

Task 10:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

Task 11:

LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

References:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

Course Outcomes:

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LAtEX.
- Prepare Slide presentations using the presentation tool.
- Interconnect two or more computers for information sharing.
- Access the Internet and Browse it to obtain the required information.

Note: Use open source tools for implementation of the above exercises.

(20A05201P) C-PROGRAMMING & DATA STRUCTURES LAB

(Common to All Branches of Engineering)

Course Objectives:

- To get familiar with the basic concepts of C programming.
- To design programs using arrays, strings, pointers and structures.
- To illustrate the use of Stacks and Queues
- To apply different operations on linked lists.
- To demonstrate Binary search tree traversal techniques.
- To design searching and sorting techniques.

Week 1

Write C programs that use both recursive and non-recursive functions

- To find the factorial of a given integer.
- To find the GCD (greatest common divisor) of two given integers.
- To solve Towers of Hanoi problem.

Week 2

- Write a C program to find both the largest and smallest number in a list of integers.
- Write a C program that uses functions to perform the following:
 - Addition of Two Matrices
 - Multiplication of Two Matrices

Week 3

- Write a C program that uses functions to perform the following operations:
 - To insert a sub-string in to a given main string from a given position.
 - To delete n characters from a given position in a given string.

Week 4

- Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
- Write a C program to count the lines, words and characters in a given text.

Week 5

- Write a C Program to perform various arithmetic operations on pointer variables.
- Write a C Program to demonstrate the following parameter passing mechanisms:
 - call-by-value
 - call-by-reference

Week 6

Write a C program that uses functions to perform the following operations:

- i) Reading a complex number
- ii) Writing a complex number
- iii) Addition of two complex numbers
- iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 7

Write C programs that implement stack (its operations) using

- i) Arrays
- ii) Pointers

Week 8

Write C programs that implement Queue (its operations) using

- i) Arrays
- ii) Pointers

Week 9

Write a C program that uses Stack operations to perform the following:

- i) Converting infix expression into postfix expression
- ii) Evaluating the postfix expression

Week 10

Write a C program that uses functions to perform the following operations on singly linked list.

- i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 11

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

- i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on circular linkedlist.

- i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following:

- i) Creating a Binary Tree of integers
- ii) Traversing the above binary tree in preorder, inorder and postorder.

Week 14

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

- i) Linear search
- ii) Binary search

Week 15

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

- i) Bubble sort
- ii) Selection sort
- iii) Insertion sort

Text Books:

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. B.A. Forouzan and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Course Outcomes

- Demonstrate basic concepts of C programming language. (L2)
- Develop C programs using functions, arrays, structures and pointers. (L6)
- Illustrate the concepts Stacks and Queues. (L2)
- Design operations on Linked lists. (L6)
- Apply various Binary tree traversal techniques. (L3)
- Develop searching and sorting methods. (L6)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (EEE)– II Sem

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(20A51101P) CHEMISTRY LAB

(CSE, AI & DS, CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT, ECE, EEE and IT)

Course Objectives:

- Verify the fundamental concepts with experiments

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method
2. Models of potential energy surfaces
3. Conductometric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite and measurement of its mechanical properties (strength.).
8. Verify Lambert-Beer's law
9. Thin layer chromatography
10. Identification of simple organic compounds by IR.
11. Preparation of nanomaterial's by precipitation
12. Estimation of Ferrous Iron by Dichrometry.

Course Outcomes:

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

- Determine the cell constant and conductance of solutions (L3)
- Prepare advanced polymer Bakelite materials (L2)
- Measure the strength of an acid present in secondary batteries (L3)
- Analyse the IR of some organic compounds (L3)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (EEE)– II Sem **L T P C**
0 0 3 1.5
(20A04101P) ELECTRONIC DEVICES & CIRCUITS LAB

Course Objectives:

- To verify the theoretical concepts practically from all the experiments.
- To analyse the characteristics of Diodes, BJT, MOSFET, UJT.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim.

LIST OF EXPERIMENTS: (Execute any 12 experiments).

Note: All the experiments shall be implemented using both Hardware and Software.

1. Verification of Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs obtained.
2. Design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. Draw suitable graphs.
3. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.
4. Design a Zener diode-based *voltage regulator* against variations of supply and load. Verify the same from the experiment.
5. Study and draw the *output* and *transfer* characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find *Threshold voltage (V_T)*, *g_m* & *K* from the graphs.
6. Study and draw the *output* and *transfer* characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find *I_{DSS}* , *g_m* & *V_P* from the graphs.
7. Verification of the input and output characteristics of BJT in **Common Emitter** configuration experimentally and find required *h – parameters* from the graphs.
8. Study and draw the input and output characteristics of BJT in **Common Base** configuration experimentally, and determine required *h – parameters* from the graphs.
9. Study and draw the Volt Ampere characteristics of UJT and determine *η , I_B , I_v , V_B & V_V* from the experiment.
10. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
11. Design and analysis of voltage- divider bias/self-bias circuit using JFET.
12. Design and analysis of self-bias circuit using MOSFET.
13. Design a suitable circuit for switch using CMOSFET/JFET/BJT.
14. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.
15. Design a small signal amplifier using BJT(common emitter) for the given specifications. Draw the frequency response and find the bandwidth.

Tools / Equipment Required: Software Toollike Multisim/Pspice or Equivalent, DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Course Outcomes:

- Understand the basic characteristics and applications of basic electronic devices. (L1)Observe the characteristics of electronic devices by plotting graphs. (L2)
- Analyze the Characteristics of UJT, BJT, MOSFET (L3).
Design MOSFET / BJT based amplifiers for the given specifications. (L4)
Simulate all circuits in PSPICE /Multisim. (L5).

(20A99201) ENVIRONMENTAL SCIENCE

(Common to All Branches of Engineering)

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

UNIT – I

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – 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 – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Learning outcomes:

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

- To know the importance of public awareness
- To know about the various resources

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning outcomes:

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

- To know about various eco systems and their characteristics
- To know about the biodiversity and its conservation

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of :

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning outcomes:

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

- To know about the various sources of pollution.
- To know about the various sources of solid waste and preventive measures.
- To know about the different types of disasters and their managerial measures.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Learning outcomes:

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

- To know about the social issues related to environment and their protection acts.
- To know about the various sources of conservation of natural resources.
- To know about the wild life protection and forest conservation acts.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human

Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Learning outcomes:

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

- To know about the population explosion and family welfare programmes.
- To identify the natural assets and related case studies.

TEXT BOOKS:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

REFERENCES:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

Course Outcomes:

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

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes.

II B.TECH.

Semester– IV							
S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54402	Numerical Methods & Probability Theory	BS	3	0	0	3
2.	20A04404T	Analog Electronic Circuits	ES	3	0	0	3
3.	20A02401T	Power Electronics	PC	3	0	0	3
4.	20A02402T	AC Machines	PC	3	0	0	3
5.	20A02403T	Electromagnetic Field Theory	PC	3	0	0	3
6.	20A04404P	Analog Electronic Circuits Lab	PC	0	0	3	1.5
7.	20A02401P	Power Electronics Lab	PC	0	0	3	1.5
8.	20A02402P	AC Machines Lab	PC	0	0	3	1.5
9.	20A02404	Skill oriented course – II Circuits Simulation & Analysis using PSPICE	SC	1	0	2	2
10	20A99401	Mandatory noncredit course – III Design Thinking for Innovation	MC	2	1	0	0
Total							21.5
Community Service Internship (Mandatory) for 6 weeks duration during summer vacation							

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Note:

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during third semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester



Course Code	Complex variables and Transforms		L	T	P	C
20A54302	(Common to ECE & EEE)		3	0	0	3
Pre-requisite	Functions, Differentiations and Integration	Semester	III			
Course Objectives:						
This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.						
Course Outcomes (CO): Student will be able to						
<ul style="list-style-type: none"> Understand the analyticity of complex functions and conformal mappings. Apply cauchy's integral formula and cauchy's integral theorem to evaluate improper integrals along contours. Understand the usage of laplace transforms, fourier transforms and z transforms. Evaluate the fourier series expansion of periodic functions. Understand the use of fourier transforms and apply z transforms to solve difference equations. 						
UNIT - I	Complex Variable – Differentiation:		8 Hrs			
Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations ($\sin z$, e^z , $\cos z$, z^2) Mobius transformations (bilinear) and their properties.						
UNIT - II	Complex Variable – Integration:		9 Hrs			
Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with $f(z)$ not having poles on real axis).						
UNIT - III	Laplace Transforms		9 Hrs			
Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.						
UNIT - IV	Fourier series		8 Hrs			
Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval's formula- Complex form of Fourier series.						
UNIT - V	Fourier transforms & Z Transforms:		9 Hrs			
Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem . Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.						

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Textbooks:
1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India
Reference Books:
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.
Online Learning Resources:
1. nptel.ac.in/courses/111107056
2. onlinelibrary.wiley.com
3. https://onlinecourses.nptel.ac.in/noc18ma12



Course Code	ELECTRICAL CIRCUIT ANALYSIS		L	T	P	C
20A02301T			3	0	0	3
Pre-requisite	Fundamentals of Electrical Circuits	Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits. Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations. To know the applications of Fourier transforms to electrical circuits excited by non sinusoidal sources. Study of Different types of filters, equalizers. 						
Course Outcomes (CO):						
<ul style="list-style-type: none"> Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits. To get knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations. Applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources are known. To design filters and equalizers. 						
UNIT - I	Locus Diagrams & Resonance		8 Hrs			
Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.						
UNIT - II	Two Port Networks		9 Hrs			
Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.						
UNIT - III	Transient Analysis		12 Hrs			
D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions in network - Initial Conditions in elements - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation. A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Solution Method Using Differential Equations and Laplace Transforms.						
UNIT - IV	Fourier Transforms		10 Hrs			
Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.						
UNIT - V	Filters		9 Hrs			
Filters – Low Pass – High Pass, Band Pass and Band Stop– RC, RL filters– derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type - T type and Bridged – T and Lattice Equalizers.						
Textbooks:						

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1. William Hayt, Jack E. Kemmerly and Jamie Phillips, “Engineering Circuit Analysis”, Mc Graw Hill, 9th Edition, 2019.
2. A. Chakrabarti, “Circuit Theory: Analysis & Synthesis”, Dhanpat Rai & Sons, 2008.

Reference Books:

1. M.E. Van Valkenberg, “Network Analysis”, 3rd Edition, Prentice Hall (India), 1980.
2. V. Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall International, 2009.
3. Charles K. Alexander and Matthew. N. O. Sadiku, “Fundamentals of Electric Circuits” Mc Graw Hill, 5th Edition, 2013.
4. MahamoodNahvi and Joseph Edminister, “Electric Circuits” Schaum’s Series, 6th Edition, 2013.
5. John Bird, Routledge, “Electrical Circuit Theory and Technology”, Taylor & Francis, 5th Edition, 2014.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc21_ee99/preview
- https://onlinecourses.nptel.ac.in/noc21_ee14/preview

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	DC MACHINES & TRANSFORMERS		L	T	P	C
20A02302T			3	0	0	3
Pre-requisite	Fundamentals of Electrical circuits and Magnetic circuits	Semester	III			
Course Objectives:						
Student will be able to						
<ul style="list-style-type: none"> Study magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters. understand the constructional details of DC machines and Transformers Analyze the performance characteristics of DC machines and transformer Evaluate efficiency, regulation and load sharing of DC machines and transformers Design Equivalent circuit of transformer 						
Course Outcomes (CO):						
At the end of this course, students will demonstrate the ability to						
<ul style="list-style-type: none"> Understand the concepts of magnetic circuits, principle and operations of DC machines, starters and single and three phase transformers Analyze armature reaction, parallel operation, speed control and characteristics of DC machines. Also analyze the performance characteristics with the help of OC and SC tests of transformer Evaluate generated emf, back emf, speed, efficiency and regulations of DC machines and efficiency and regulation of transformer also load sharing of parallel connected transformers Design winding diagrams of DC machines and equivalent circuit of transformer. 						
UNIT - I	Magnetic Material Properties and Applications:		10 Hrs			
Introduction, Magnetic materials and their properties, magnetically induced emf and force, AC operation of magnetic circuits, hysteresis and eddy current losses, permanent magnets, and applications of permanent magnet materials.						
Principles of electromechanical energy conversion:						
Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems, forces/torques in systems with permanent magnets, energy conversion via electric field, dynamical equations of electro mechanical systems						
UNIT - II	DC Generators		9Hrs			
Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation, armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation, emf induced in a coil undergoing commutation, methods of improving commutation, OCC and load characteristics of different types of generators. Parallel operation of DC Generators: DC shunt and series generators in parallel, equalizing connections						
UNIT - III	DC Motors		10 Hrs			
Force on conductor carrying current, back emf, Torque and power developed by armature, speed control of DC motors (Armature control and Flux control methods), Necessity of starters, constructional details of 3-point and 4-point starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency						
Testing of DC machines:						
Brake test, Swinburne's test, Hopkinson's test, Fields test, Retardation test.						
UNIT - IV	Single Phase Transformers		10 Hrs			
Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagrams (no load and on load), Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, losses and efficiency Testing - open circuit and short						

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circuit tests, voltage regulation, Sumpner's test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer.

UNIT - V

Three Phase Transformers

9 Hrs

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- Cooling of transformers.

Textbooks:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc21_ee71/preview
- https://onlinecourses.nptel.ac.in/noc21_ee24/preview



Course Code	DIGITAL LOGIC DESIGN (Common to ECE and EEE)		L	T	P	C
20A04303T			3	0	0	3
Pre-requisite	NIL	Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> To familiarize with the concepts of different number systems and Boolean algebra. To introduce the design techniques of combinational, sequential logic circuits. To model combinational and sequential circuits using HDLs. 						
Course Outcomes (CO):						
CO1: Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh map.						
CO2: Make use of the concepts to solve the problems related to the logic circuits.						
CO3: Analyze the combinational and sequential logic circuits.						
CO4: Develop digital circuits using HDL, and Compare various Programmable logic devices						
CO5: Design various logic circuits using Boolean algebra, combinational and sequential logic circuits.						
UNIT - I	Number Systems, Boolean algebra and Logic Gates					
Number systems - binary numbers, octal, hexadecimal, other binary codes; complements, signed binary numbers, digital logic operations and gates, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, complements of Boolean functions, two-level NAND and NOR Implementation of Boolean functions.						
UNIT - II	Minimization of Boolean functions and Combinational Logic Circuits					
The Karnaugh map method (up to five variables), product of sums simplifications, don't care conditions, Tabular method, Introduction, Combinational circuits, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, decoders and encoders, multiplexers, demultiplexers,						
UNIT - III	Sequential Logic Circuits					
Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers, universal shift register						
UNIT - IV	Finite State Machines and Programmable Logic Devices					
Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector.						
UNIT - V	Hardware Description Language					
Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs, Introduction to Verilog - structural Specification of logic circuits, behavioural specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop; using storage elements with CAD tools-using Verilog constructs for storage elements, flip-flop with clear capability, using Verilog constructs for registers and counters.						
Textbooks:						

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| <ol style="list-style-type: none">1. M. Morris Mano, “Digital Design”, 3rd Edition, PHI. (Unit I to IV)2. Stephen Brown and Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog Design”, 3rd Edition, McGraw-Hill (Unit V) |
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Reference Books:

- | |
|---|
| <ol style="list-style-type: none">1. Charles H. Roth, Jr, “Fundamentals of Logic Design”, 4th Edition, Jaico Publishers.2. Zvi Kohavi and Niraj K. Jha, “Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.3. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, 2nd Edition, Prentice Hall PTR.4. D.P. Leach, A.P. Malvino, “Digital Principles and Applications”, TMH, 7th Edition. |
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UNIT - V	Financial Accounting and Analysis
Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.	
Textbooks: <ol style="list-style-type: none"> 1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013. 2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019 	
Reference Books: <ol style="list-style-type: none"> 1. Ahuja Hl Managerial economics Schand,3/e,2013 2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013. 3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi. 4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013. 	
Online Learning Resources: https://www.slideshare.net/123ps/managerial-economics-ppt https://www.slideshare.net/rossanz/production-and-cost-45827016 https://www.slideshare.net/darkyla/business-organizations-19917607 https://www.slideshare.net/balarajbl/market-and-classification-of-market https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396 https://www.slideshare.net/ashu1983/financial-accounting	



Course Code	ORGANISATIONAL BEHAVIOUR (Common to All branches of Engineering)		L	T	P	C
20A52302			3	0	0	3
Pre-requisite	NIL	Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> To enable student's comprehension of organizational behavior To offer knowledge to students on self-motivation, leadership and management To facilitate them to become powerful leaders To Impart knowledge about group dynamics To make them understand the importance of change and development 						
Course Outcomes (CO):						
<ul style="list-style-type: none"> Define the Organizational Behaviour, its nature and scope. Understand the nature and concept of Organizational behaviour Apply theories of motivation to analyse the performance problems Analyse the different theories of leadership Evaluate group dynamics Develop as powerful leader 						
UNIT - I	Introduction to Organizational Behavior					
Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.						
UNIT - II	Motivation and Leading					
Theories of Motivation- Maslow's Hierarchy of Needs - Herzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Clelland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory – Locke's goal setting theory– Alderfer's ERG theory .						
UNIT - III	Organizational Culture					
Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader- Women and Corporate leadership.						
UNIT - IV	Group Dynamics					
Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution						
UNIT - V	Organizational Change and Development					
Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development						
Textbooks:						
1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011 2. P Subba Ran, Organisational Behaviour, Himalya Publishing House 2017						
Reference Books:						
<ul style="list-style-type: none"> McShane, Organizational Behaviour, TMH 2009 Nelson, Organisational Behaviour, Thomson, 2009. Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009. Aswathappa, Organisational Behaviour, Himalaya, 2009 						
Online Learning Resources:						

Course Code	Business Environment (Common to All branches of Engineering)		L	T	P	C
20A52303			3	0	0	3
Pre-requisite	NIL	Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> To make the student to understand about the business environment To enable them in knowing the importance of fiscal and monetary policy To facilitate them in understanding the export policy of the country To Impart knowledge about the functioning and role of WTO To Encourage the student in knowing the structure of stock markets 						
Course Outcomes (CO):						
<ul style="list-style-type: none"> Define Business Environment and its Importance. Understand various types of business environment. Apply the knowledge of Money markets in future investment Analyse India's Trade Policy Evaluate fiscal and monetary policy Develop a personal synthesis and approach for identifying business opportunities 						
UNIT - I	Overview of Business Environment					
Introduction – meaning Nature, Scope, significance, functions and advantages. Types-Internal & External, Micro and Macro. Competitive structure of industries -Environmental analysis-advantages & limitations of environmental analysis& Characteristics of business.						
UNIT - II	Fiscal & Monetary Policy					
Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.						
UNIT - III	India's Trade Policy					
Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.						
UNIT - IV	World Trade Organization					
Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.						
UNIT - V	Money Markets and Capital Markets					
Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.						

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Textbooks:

1. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.
2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition. HPH 2016

Reference Books:

1. K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4. E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

Online Learning Resources:

- <https://www.slideshare.net/ShompaDhali/business-environment-53111245>
<https://www.slideshare.net/rbalsells/fiscal-policy-ppt>
<https://www.slideshare.net/aguness/monetary-policy-presentationppt>
<https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982>
<https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt>
<https://www.slideshare.net/viking2690/wto-ppt-60260883>
<https://www.slideshare.net/prateeknepal3/ppt-mo>



Course Code	ELECTRICAL CIRCUIT ANALYSIS LAB		L	T	P	C
20A02301P			0	0	3	1.5
Pre-requisite	Electrical circuits	Semester	III			
Course Objectives:						
<ul style="list-style-type: none"> Understand and experimentally verify various resonance phenomenon. Understand and analyze various current locus diagrams. Apply and experimentally analyze two port network parameters 						
Course Outcomes (CO):						
<ul style="list-style-type: none"> Understand and experimentally verify various resonance phenomenon. Understand and analyze various current locus diagrams. Apply and experimentally analyze two port network parameters 						
List of Experiments:						
1. Locus Diagram of RL Series Circuits: a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R' 2. Locus Diagram of RC Series Circuits: a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R' 3. Series Resonance 4. Parallel Resonance 5. Determination of Z Parameters 6. Determination of Y Parameters 7. Transmission Parameters 8. Hybrid Parameters 9. Determination of Coefficient of coupling 10. Response Analysis of R, RL and RLC circuits with sinusoidal and non-sinusoidal excitations.						
References:						
David A. Bell, Fundamentals of Electric Circuits: Lab Manual OUP Canada, 7th Edition, 2009.						
Online Learning Resources/Virtual Labs:						
<ul style="list-style-type: none"> http://vlabs.iitkgp.ernet.in/asnm/index.html https://vlab.amrita.edu/?sub=1&brch=75 http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php 						



Course Code	DC MACHINES & TRANSFORMERS LAB		L	T	P	C
20A02302P			0	0	3	1.5
Pre-requisite	DC Machines and Transformer	Semester	III			
Course Objectives:						
To conduct various experiments on <ul style="list-style-type: none"> • DC motors and DC Generators • The speed control techniques of DC motors. • To conduct various experiments for testing on 1-phase transformers 						
Course Outcomes (CO):						
<ul style="list-style-type: none"> • Able to conduct and analyze load test on DC shunt generator • Able to understand and analyze magnetization characteristics of DC shunt generator • Able to understand and analyze speed control techniques and efficiency of DC machines • Able to understand to predetermine efficiency and regulation of single-phase Transformers 						
List of Experiments:						
Minimum ten experiments from the following list are required to be conducted <ol style="list-style-type: none"> 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. Brake test on DC shunt motor. Determination of performance curves. 4. Swinburne's test on DC shunt motor, Predetermination of efficiency. 5. Speed control of DC shunt motor (Armature control and Field control method). 6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency. 7. OC and SC test on single phase transformer 8. Parallel operation of single phase transformers. 9. Sumpner's test on single phase transformers. 10. Load test on DC long shunt compound generator. Determination of characteristics. 11. Load test on DC short shunt compound generator. Determination of characteristics. 12. Separation of losses in DC shunt motor. 13. Separation of losses of single phase transformer 						
References:						
D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017						
Online Learning Resources/Virtual Labs:						
<ul style="list-style-type: none"> • http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering • http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html 						



Course Code 20A04303P		DIGITAL DESIGN LAB (Common to ECE and EEE)	L	T	P	C
			0	0	3	1.5
Pre-requisite	NIL		Semester	IV		
Course Objectives:						
<ul style="list-style-type: none"> To understand various pin configurations of the Digital ICs used in the laboratory To conduct the experiments and verify the truth tables of various logic circuits. To analyze the logic circuits To design sequential and combinational logic circuits and verify their properties. To design of any sequential/combinational circuit using Hardware Description Language. 						
Course Outcomes (CO):						
CO1: Understand the pin configuration of various digital ICs used in the lab						
CO2: Conduct the experiment and verify the properties of various logic circuits.						
CO3: Analyze the sequential and combinational circuits.						
CO4: Design of any sequential/combinational circuit using Hardware/ HDL.						
List of Experiments:						
<ol style="list-style-type: none"> Verification of truth tables of the following Logic gates Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit. Verification of functional table of 3 to 8-line Decoder /De-multiplexer 4variable logic function verification using 8 to 1 multiplexer. Design full adder circuit and verify its functional table. Verification of functional tables of (i) JK Edge triggered Flip-Flop (ii) JK Master Slav Flip-Flop (iii) D Flip-Flop Design a four-bit ring counter using D Flip-Flops/JK Flip Flop and verify output Design a four bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output Verify the operation of 4-bit Universal Shift Register for different Modes of operation. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms. Design MOD-8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms. Draw the circuit diagram of a single bit comparator and test the output (b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it. 						
ADD on Experiments:						
<ol style="list-style-type: none"> Design BCD Adder Circuit and Test the Same using Relevant IC Design Excess-3 to 9- Complement convertor using only four Full Adders and test the Circuit. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs. Design of any combinational circuit using Hardware Description Language Design of any sequential circuit using Hardware Description Language 						
References:						
M. Morris Mano, "Digital Design", 3rd Edition, PHI						
Online learning resources/virtual labs: https://www.ylab.co.in/						

Course Code	Application Development with Python		L	T	P	C
20A05305			1	0	2	2
Pre-requisite	NIL	Semester	III			

Course Objectives:

- To learn the basic concepts of software engineering and life cycle models
- To explore the importance of Databases in application Development
- Acquire programming skills in core Python
- To understand the importance of Object-oriented Programming

Course Outcomes (CO):

Students should be able to

- Identify the issues in software requirements specification and enable to write SRS documents for software development problems
- Explore the use of Object oriented concepts to solve Real-life problems
- Design database for any real-world problem
- Solve mathematical problems using Python programming language

Module 1. Basic concepts in software engineering and software project management

Basic concepts: abstraction versus decomposition, the evolution of software engineering techniques, Software development life cycle
Software project management: project planning and project scheduling

Task:

- [Identifying the Requirements from Problem Statements](#)

Module 2. Basic Concepts of Databases

Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, [Data Definition Language\(DDL\) Statements: \(Create table, Alter table, Drop table\)](#), [Data Manipulation Language\(DML\) Statements](#)

Task:

- Implement [Data Definition Language\(DDL\) Statements: \(Create table, Alter table, Drop table\)](#)
- Implement [Data Manipulation Language\(DML\) Statements](#)

Module 3. Python Programming:

Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements

Python Data Structures: Lists, Dictionaries, Tuples.

Strings: Creating strings and basic operations on strings, string testing methods.

Functions: Defining a function- Calling a function- Types of functions-Function Arguments- Anonymous functions- Global and local variables

OOPS Concepts; Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

Modules and Packages: Standard modules-Importing own module as well as external modules
Understanding Packages Powerful Lambda function in python Programming using functions, modules and external packages

Working with Data in Python: Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

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Tasks:

1. OPERATORS

- Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.
- Read your name and age and write a program to display the year in which you will turn 100 years old.
- Read radius and height of a cone and write a program to find the volume of a cone.
- Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

2. CONTROL STRUCTURES

- Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if...elif...else statement.
- Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.
- Write a Program to find the sum of a Series $1/1! + 2/2! + 3/3! + 4/4! + \dots + n/n!$. (Input :n = 5, Output : 2.70833)
- In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

3: LIST

- Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
- Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)
- Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).
- Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

4: TUPLE

- Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
- Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test_list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”,), (“Gfg”, “CS”)], Output : [(,“GFG”, „IS“, „BEST“)]).
- Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

5: SET

- Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).
- Write a program to perform union, intersection and difference using Set A and Set B.
- Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output: No. of vowels : 3)
- Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

6: DICTIONARY

- Write a program to do the following operations:
 - Create a empty dictionary with dict() method
 - Add elements one at a time

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- iii. Update existing key's value
- iv. Access an element using a key and also get() method
- v. Deleting a key value using del() method
- b. Write a program to create a dictionary and apply the following methods:
 - i. pop() method
 - ii. popitem() method
 - iii. clear() method
- c. Given a dictionary, write a program to find the sum of all items in the dictionary.
- d. Write a program to merge two dictionaries using update() method.

7: STRINGS

- a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
- b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
- c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
- d. Write a program to read a string and count how many times each letter appears. (Histogram).

8: USER DEFINED FUNCTIONS

- a. A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
- b. Write a function merge_dict(dict1, dict2) to merge two Python dictionaries.
- c. Write a fact() function to compute the factorial of a given positive number.
- d. Given a list of n elements, write a linear_search() function to search a given element x in a list.

9: BUILT-IN FUNCTIONS

- a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
- b. Write a program to demonstrate the working of built-in trigonometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
- c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
- d. Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

10. CLASS AND OBJECTS

- a. Write a program to create a BankAccount class. Your class should support the following methods for
 - i) Deposit
 - ii) Withdraw
 - iii) GetBalance
 - iv) PinChange
- b. Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint: use Inheritance).
- c. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info() method and also using dictionary (__dict__).
- d. Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

11. FILE HANDLING

- a. . Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform

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the following operations:

- i. Count the sentences in the file.
 - ii. Count the words in the file.
 - iii. Count the characters in the file.
- b. . Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied.
- c. Write a Python program to store N student's records containing name, roll number and branch. Print the given branch student's details only.

References:

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. RamezElmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
3. Reema Thareja, "Python Programming - Using Problem Solving Approach", Oxford Press, 1st Edition, 2017.
4. Larry Lutz, "Python for Beginners: Step-By-Step Guide to Learning Python Programming", CreateSpace Independent Publishing Platform, First edition, 2018

Online Learning Resources/Virtual Labs:

1. <http://vlabs.iitkgp.ernet.in/se/>
2. <http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php>
3. <https://python-iitk.vlabs.ac.in>

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<p>values in relationship Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.</p> <p>Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives</p>		
UNIT – IV	Understanding Harmony in the Nature and Existence - Whole existence as Coexistence	10 Hrs
<p>Understanding the harmony in the Nature Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature Understanding Existence as Co-existence of mutually interacting units in all- pervasive space Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.</p>		
UNIT – V	Implications of the above Holistic Understanding of Harmony on Professional Ethics	8 Hrs
<p>Natural acceptance of human values Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.</p>		
Textbooks:		
<p>R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 R R Gaur, R Asthana, G P Bagaria, “Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2</p>		
Reference Books:		
<p>Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999. A. N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, 2004. The Story of Stuff (Book). 4. Mohandas Karamchand Gandhi “The Story of My Experiments with Truth” 5. E. F.Schumacher. “Small is Beautiful” Slow is Beautiful –Cecile Andrews J C Kumarappa “Economy of Permanence” Pandit Sunderlal “Bharat Mein Angreji Raj” Dharampal, “Rediscovering India” Mohandas K. Gandhi, “Hind Swaraj or Indian Home Rule” India Wins Freedom - Maulana Abdul Kalam Azad Vivekananda - Romain Rolland(English) Gandhi - Romain Rolland (English)</p>		

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MODE OF CONDUCT

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.



Course Code 20A54402	Numerical Methods & Probability Theory (Common to EEE, MECH)	L 3	T 0	P 0	C 3
Pre-requisite	Basic Equations and Basic Probability	Semester	IV		
Course Objectives:					
This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations, the theory of Probability and random variables.					
Course Outcomes (CO): Student will be able to					
<ul style="list-style-type: none"> • Apply numerical methods to solve algebraic and transcendental equations • Derive interpolating polynomials using interpolation formulae • Solve differential and integral equations numerically • Apply Probability theory to find the chances of happening of events. • Understand various probability distributions and calculate their statistical constants. • 					
UNIT - I	Solution of Algebraic & Transcendental Equations:	8 Hrs			
Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.					
UNIT - II	Interpolation	8 Hrs			
Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.					
UNIT - III	Numerical Integration & Solution of Initial value problems to Ordinary differential equations	9 Hrs			
Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.					
UNIT - IV	Probability theory:	9 Hrs			
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.					
UNIT - V	Random variables & Distributions	9 Hrs			
Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution					
Textbooks:					
<ol style="list-style-type: none"> 1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, PNIE. 3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India. 					
Reference Books:					
<ol style="list-style-type: none"> 1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier. 					
Online Learning Resources:					
<ol style="list-style-type: none"> 1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview 2. nptel.ac.in/courses/117101056/17 3. http://nptel.ac.in/courses/111105090 					



Course Code	ANALOG ELECTRONIC CIRCUITS		L	T	P	C
20A04404T			3	0	0	3
Pre-requisite	Network Analysis, Electronic Devices and Circuits	Semester	IV			
Course Objectives:						
<ul style="list-style-type: none"> List various types of feedback amplifiers, oscillators and large signal Amplifiers. Explain the operation of various electronic circuits and linear ICs. Apply various types of electronic circuits to solve engineering problems Analyse various electronic circuits and regulated power supplies for proper understanding Justify choice of transistor configuration in a cascade amplifier. Design electronic circuits for a given specification. 						
Course Outcomes (CO):						
CO1. List various types of feedback amplifiers, oscillators and large signal amplifiers						
CO2. Explain the operation of various electronic circuits and linear ICs						
CO3. Apply various types of electronic circuits to solve engineering problems						
CO4. Analyze various electronic circuits and regulated power supplies for proper understanding						
CO5. Justify choice of transistor configuration in a cascade amplifier						
CO6. Design electronic circuits for a given specification						
UNIT - I		Multistage Amplifiers				
Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascode amplifier.						
UNIT - II		Feedback Amplifiers and Oscillators				
Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage–shunt.						
Oscillators: Sinusoidal Oscillators, Conditions for oscillations, Phase-shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).						
UNIT - III		Large Signal Amplifiers (Power Amplifiers)				
Introduction, Classification, Class A large signal amplifiers, Second - Harmonic Distortion, Higher - Order Harmonic Generations, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A, Class B, Class AB Amplifiers, Distortion in Power Amplifiers, Class C Power Amplifier.						
UNIT - IV		Operational Amplifier				
Introduction, Block diagram, Characteristics and Equivalent circuits of an ideal op-amp, Various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations. The Practical op-amp: Introduction, Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain–bandwidth product, frequency limitations and compensations, transient response.						
UNIT - V		Applications of OP-AMPs and Special ICs				
Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier, Converters: Current to voltage and voltage to current converters, Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters, Oscillators: RC phase shift oscillator, Wien bridge oscillator, Square wave generator.						
Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of						

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Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO566, PLL565, Fixed and variable Voltage regulators.

Textbooks:

- Millman, Halkias and Jit , “Electronic Devices and Circuits” , 4th Edition , McGraw Hill Education (India) Private Ltd.,2015.
- Salivahanan and N. Suresh Kumar, “ Electronic Devices and Circuits”,4thEdition,McGrawHill Education(India)Private Ltd.,2017.
- Ramakanth A. Gayakwad, “Op-Amps& LinearICs”,4thEdition, Pearson, 2017.

Reference Books:

- Millman and Taub, Pulse, Digital and Switching Waveforms, 3rdEdition, TataMcGraw-Hill Education, 2011.
- J. Milliman, C.C. Halkias and Chetan Parikh, “Integrated Electronics”, 2ndEdition, McGraw Hill, 2010.
- David A. Bell, “ Electronic Devices and Circuits”, 5thedition,OxfordPress,2008.
- D. Roy Choudhury, “LinearIntegratedCircuits”,2ndEdition, New Age International (p)Ltd,2003.



Course Code	POWER ELECTRONICS		L	T	P	C
20A02401T			3	0	0	3
Pre-requisite	Electrical circuits and semiconductor devices	Semester	IV			
Course Objectives:						
The student will be able to:						
<ul style="list-style-type: none"> Understand the differences between signal level and power level devices. Analyze controlled rectifier circuits. Analyze the operation of DC-DC choppers. Analyze the operation of voltage source inverters. 						
Course Outcomes (CO):						
At the end of this course students will be able to:						
<ul style="list-style-type: none"> Understand the operation, characteristics and usage of basic Power Semiconductor Devices. Understand different types of Rectifier circuits with different operating conditions. Understand DC-DC converters operation and analysis of their characteristics. Understand the construction and operation of voltage source inverters, Voltage Controllers and Cyclo Converters. Apply all the above concepts to solve various numerical problem solving 						
UNIT - I	Power Switching Devices		9 Hrs			
Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO. Introduction to Gallium Nitride and Silicon Carbide Devices.						
UNIT - II	Rectifiers		10 Hrs			
Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance; Analysis of rectifiers with filter capacitance, Dual Converter -Numerical problems.						
UNIT - III	DC-DC CONVERTERS		9 Hrs			
Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.						
UNIT - IV	INVERTERS		10 Hrs			
Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.						
UNIT - V	AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS:				10 Hrs	
AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems.						
Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output						

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voltage equation.

Textbooks:

1. M. H. Rashid, “Power Electronics: Circuits, Devices and Applications”, 2nd edition, Prentice Hall of India, 1998
2. P.S.Bimbhra, “Power Electronics”, 4th Edition, Khanna Publishers, 2010.
3. M. D. Singh & K. B. Kanchandhani, “Power Electronics”, Tata Mc Graw Hill Publishing Company, 1998.

Reference Books:

1. Ned Mohan, “Power Electronics”, Wiley, 2011.
2. Robert W. Erickson and Dragan Maksimovic, “Fundamentals of Power Electronics” 2nd Edition, Kluwer Academic Publishers, 2004.
3. Vedam Subramanyam, “Power Electronics”, New Age International (P) Limited, 1996.
4. V.R.Murthy, “Power Electronics”, 1st Edition, Oxford University Press, 2005.
5. P.C.Sen, “Power Electronics”, Tata Mc Graw-Hill Education, 1987.
5. “Power Electronic Control of Alternating Current Motors” by J.M.D.Murphy

Online Learning Resources:

<https://www.classcentral.com/course/youtube-electrical-power-electronics-47667/classroom>
https://onlinecourses.nptel.ac.in/noc21_ee01/preview



Course Code	AC MACHINES		L	T	P	C
20A02402T			3	0	0	3
Pre-requisite	Electrical circuits, Magnetic circuits, DC machines and transformers	Semester	IV			
Course Objectives:						
<p>The students will be able to:</p> <ul style="list-style-type: none"> Understand the fundamentals of AC machines, know equivalent circuit performance characteristics. Understand the methods of starting of Induction motors. Understand the methods of starting of Synchronous motors. Understand the parallel operation of Alternators. 						
Course Outcomes (CO):						
<p>At the end of this course, students will be able to:</p> <ul style="list-style-type: none"> Understand the basics of ac machine windings, construction, principle of working, equivalent circuit of induction and synchronous machines. Analyze the phasor diagrams of induction and synchronous machine, parallel operation of alternators, synchronization and load division of synchronous generators. Apply the concepts to determine V and inverted V curves and power circles of synchronous motor. Analyze the various methods of starting in both induction and synchronous machines. 						
UNIT - I	Fundamentals of AC machine windings		9Hrs			
Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factors.						
UNIT - II	Induction Machines		10 Hrs			
Operating principle, Construction, Types (squirrel cage and slip-ring), Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Torque-Slip Characteristics, power flow in induction machines, Losses and Efficiency, No load and blocked rotor test, Circle diagram, performance characteristics, Numerical problems. Methods of starting, braking and speed control for induction motors, Doubly-Fed Induction Machines, crawling and cogging. Analysis of 3 phase induction motors with single phasing operation.						
UNIT - III	Synchronous generators		10 Hrs			
Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation, EMF, MMF, ZPF and ASA methods. Operating characteristics of synchronous machines, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.						
UNIT - IV	Synchronous motors		10 Hrs			
Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles.						
UNIT - V	Single-phase induction motors		9 Hrs			
Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and its applications, capacitor start and run single phase						

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motors, reluctance single phase motors, stepper motors, BLDC motors.

Textbooks:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

Reference Books:

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc21_ee13/preview

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Course Code	ELECTROMAGNETIC FIELD THEORY		L	T	P	C
20A02403T			3	0	0	3
Pre-requisite	Magnetic circuits	Semester	IV			
Course Objectives:						
<ul style="list-style-type: none">To understand the basic principles of electrostaticsTo understand the basic principles of magneto statics for time invariant and time varying fieldsTo understand the principles of dielectrics, conductors and magnetic potentials						
Course Outcomes (CO):						
After completion of the course, the student will be able to: <ul style="list-style-type: none">Understand the concept of electrostaticsUnderstand the concepts of Conductors and DielectricsUnderstand the fundamental laws related to Magneto StaticsUnderstand the concepts of Magnetic Potential and Time varying Fields						
UNIT - I	ELECTROSTATICS		9 Hrs			
Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss LawApplication of Gauss Law-Maxwell's First Law – Numerical Problems. Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.						
UNIT - II	CONDUCTORS AND DIELECTRICS		9 Hrs			
Behaviour of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.						
UNIT - III	MAGNETO STATICS		11 Hrs			
Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems. Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.						
UNIT - IV	MAGNETIC POTENTIAL		9 Hrs			
Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations. Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.						
UNIT - V	TIMEVARYING FIELDS		10 Hrs			

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Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current. Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedance and Skin Depth – Poynting Theorem – Poynting Vector and its Significance.'

Textbooks:

1. Sadiku, Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford University Press, 2015
2. William.H.Hayt, "Engineering Electromagnetics", Mc Graw Hill, 2010.

Reference Books:

- 1.J.D.Kraus, "Electromagnetics", 5th Edition, Mc Graw Hill Inc, 1999.
2. David K. Cheng, "Field & Electromagnetic Waves", 2nd Edition, 1989.
3. Joseph A. Edminister, "Electromagnetics", 2nd Edition, Schaum's Outline, Mc Graw Hill, 2017.
4. K.A. Gangadhar and P.M. Ramanathan, "Electromagnetic Field Theory", 8th Reprint, Khanna Publications, 2015.

Online Learning Resources:

- <https://www.classcentral.com/course/youtube-electrical-electro-magnetic-fields-47689/classroom>
- https://onlinecourses.nptel.ac.in/noc21_ee83/preview

Note: Design & simulate any 6 experiments with Multisim/PSPICE or equivalent software and verify the results in hardware lab with discrete components.

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PART B

List of Experiments:

1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. Realization of Boolean Expressions using Gates
3. Design a 3-bit Adder/Subtractor
4. Design and realization a 4-bit Gray to Binary and Binary to Gray Converter
5. Design and construct basic flip-flops R-S, J-K, J-K Masterslave flip-flops using gates and verify their truth tables
6. Design and implementation of Mod-N synchronous counter using J-K flip-flops.
7. Design and implementation of i) Ring counter and ii) Johnson counter using 4 3 bit shift register
8. Design and realization of 8x1 MUX using 2x1 MUX

Note: Student has to perform minimum of 4 experiments using digital ICs

Online learning resources/Virtual Labs:

<https://www.vlab.co.in/>

Course Code	POWER ELECTRONICS LAB		L	T	P	C
20A02401P			0	0	3	1.5
Pre-requisite	Power Electronics	Semester	IV			
Course Objectives:						
<ul style="list-style-type: none"> Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques. Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads. Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads. Create and analyze various power electronic converters using PSPICE software. 						
Course Outcomes (CO):						
By the end of the course the student will be able to: <ul style="list-style-type: none"> Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques. Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads. Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads. Create and analyze various power electronic converters using PSPICE software. 						
List of Experiments:						
Minimum eight experiments from the following list are required to be conducted						
1. Study of Characteristics of SCR, MOSFET & IGBT 2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering 3. Single Phase AC Voltage Controller with R and RL Loads 4. Single Phase fully controlled bridge converter with R and RL loads 5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E) 6. DC Jones chopper with R and RL Loads 7. Single Phase Parallel, inverter with R and RL loads 8. Single Phase Cycloconverter with R and RL loads 9. Single Phase Half controlled converter with R and RL load 10. Single Phase Fully controlled converter with R and RL load 10. Three Phase half controlled bridge converter with R, RL-load 11. Three Phase fully controlled bridge converter with R, RL-load 11. Single Phase series inverter with R and RL loads 12. Single Phase Bridge converter with R and RL loads 13. Single Phase dual converter with RL loads						
References:						
1. O.P. Arora, "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", Alpha Science International Ltd., 2007. 2. M.H. Rashid, "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications. 3. PSPICE A/D user's manual – Microsim, USA. 4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user's manual and – Math works, USA.						
Online Learning Resources/Virtual Labs:						
<ul style="list-style-type: none"> http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php 						

Course Code	AC MACHINES LAB		L	T	P	C
20A02402P			0	0	3	1.5
Pre-requisite	AC Machines	Semester	IV			
Course Objectives:						
<ul style="list-style-type: none"> Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor. Predetermine regulation of a three-phase alternator by synchronous impedance & m.m.f methods. Predetermine the regulation of Alternator by Zero Power Factor method X_d and X_q determination of salient pole synchronous machine. Evaluate and analyze V and inverted V curves of 3 phase synchronous motor 						
Course Outcomes (CO):						
<p>By the end of the course, the student will be able to:</p> <ul style="list-style-type: none"> Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor. Predetermine regulation of a three-phase alternator by synchronous impedance & m.m.f methods. Predetermine the regulation of Alternator by Zero Power Factor method X_d and X_q determination of salient pole synchronous machine. Evaluate and analyze V and inverted V curves of 3 phase synchronous motor 						
List of Experiments:						
All the following ten experiments are required to be conducted						
<ol style="list-style-type: none"> No-load & Blocked-rotor tests on Squirrel cage Induction motor. Load test on three phase slip ring Induction motor. Speed control of three phase induction motor Rotor resistance starter for slip ring induction motor Load test on single phase induction motor. Determination of Equivalent circuit of a single phase induction motor. Predetermination of Regulation of a three phase alternator by synchronous impedance & m.m.f methods. Predetermination of Regulation of three-phase alternator by Z.P.F. method. Determination of X_d and X_q of a salient pole synchronous machine by slip test. V and inverted V curves of a 3-phase synchronous motor. 						
References:						
<ol style="list-style-type: none"> D. P.Kothari and B. S. Umre, "Laboratory Manual for Electrical Machines" I.K International Publishing House Pvt. Ltd, 2017. D.R. Kohli and S.K. Jain, "A Laboratory Course in Electrical Machines" NEM Chand & Bros. 						
Online Learning Resources/Virtual Labs:						
<ul style="list-style-type: none"> http://vem-iitg.vlabs.ac.in/ http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html 						



Course Code	CIRCUITS SIMULATION AND ANALYSIS		L	T	P	C
20A02404	USING PSPICE		1	0	2	2
Pre-requisite	Electrical Circuits, Power Electronics	Semester	IV			
Course Objectives:						
<ul style="list-style-type: none"> Simulation of various circuits using PSPICE software. Simulation of single-phase half & fully-controlled converters, and inverters Simulation of single-phase AC Voltage controllers with different loads. 						
Course Outcomes (CO)						
By the end of the course, the student will be able to:						
<ul style="list-style-type: none"> Simulation of various circuits using PSPICE software. Simulation of single-phase half & fully-controlled converters, and inverters Simulation of single-phase AC Voltage controllers with different loads. 						
List of Experiments:						
I Simulation of Electrical Circuits <ul style="list-style-type: none"> a) DC & AC Circuits b) Mesh Analysis c) Nodal Analysis d) Transient Response II Simulation of Power Electronic Circuits <ul style="list-style-type: none"> a) Single-phase half wave, Semi and full converters with RLE loads. b) Three-phase half wave, Semi and full converters with RLE loads. c) Buck, Boost and Buck-Boost Converters d) Single-phase AC voltage controller e) Single and Three phase Quasi Square wave and PWM Inverters. 						
References:						
1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009. 2. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid, M/s PHI Publications. 3. PSPICE A/D user’s manual – Microsim, USA. 4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user’s manual and – Mathworks, USA						
Online Learning Resources/Virtual Labs:						
<ul style="list-style-type: none"> http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php 						

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| 1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons. |
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Reference Books:

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| 1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H |
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Online Learning Resources:

https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://swayam.gov.in/nd1_noc19_mg60/preview

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COMMUNITY SERVICE PROJECT

.....Experiential learning through community engagement

Introduction

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

Objective

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

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

- Every student should put in a 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- 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
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty incharge.

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- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- 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.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- 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.
- The Community Service Project is a twofold one –
 - 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.
 - 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

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

Personal Outcomes

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

Social Outcomes

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

Career Development

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

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

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

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

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

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

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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**

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- 36. Blood groups and blood levels**
- 37. Internet Usage in Villages**
- 38. Android Phone usage by different people**
- 39. Utilisation of free electricity to farmers and related issues**
- 40. Gender ration in schooling level- observation.**

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

Programmes for School Children

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

Programmes for Women Empowerment

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

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
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

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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:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- 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.
- 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.
- 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 preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- 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.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

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- 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 (Three 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 work 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.