KIT - Kalaignarkarunanidhi Institute of Technology

(An Autonomous Institution)

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' GRADE & NBA (CSE, ECE, EEE, MECH, AERO & MBA)
An ISO 9001 : 2015 Certified Institution

Coimbatore - 641 402.

REGULATIONS, CURRICULUM & SYLLABUS - 2019

(For Students admitted from the Academic Year 2019-20 and onwards)

I to VIII Semester

Bachelor of Engineering
in
Electrical and Electronics Engineering

Department of Electrical and Electronics Engineering

Vision and Mission of the Department

Vision

◎	The Department strives to become one of the recognized National centres with particular focus in Electrical and Electronics Engineering.

Mission

The Mission of the EEE Department is to produce skilled and competent manpower through

◎	Quality Education
◎	Entrepreneurship Skill Development
◎	Result Oriented Research by Creating Research Centres
◎	Centre of Excellence
◎	Offering Problem Solving Community Services

Program Educational Objectives (PEO's)

PEO 1	Graduates of the programme will have successful technical or professional career.
PEO 2	Graduates will demonstrate core competence in Electrical and Electronics Engineering and leadership qualities in their chosen fields of employment.
PEO 3	Graduates will continue to learn and adapt in a world of constantly evolving technology.

Programme Outcomes (PO's)

Engineering Graduates will be able to :

PO 1	**Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis :** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design / development of solutions :** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems :** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5	**Modern tool usage :** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability :** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning :** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO's)	
After the successful completion of the U.G. programme in Electrical and Electronics Engineering, Graduates will be able to :	
PSO 1	Develop models, assess and analyze the components and systems that effectively generate, transmit and distribute electric power and protection mechanism in power systems.
PSO 2	Design and test advanced electronics systems to perform analog and digital control and deploy control strategies for Power Electronics related and other applications.

BoS Chairman

UG Regulations

1. SHORT TITLE AND COMMENCEMENT

- These Regulations shall be called the "KIT - Kalaignarkarunanidhi Institute of Technology, Coimbatore, Regulations for the Award of B.E./B.Tech., Degree".
- They have been evolved, drafted and implemented after deliberations in and approvals from UGC, Anna University and Academic Council of the Institute, and are subject to change/modifications from time to time; (major modifications at a frequency of FOUR years in synchronization with the curriculum structure revision and minor changes as and when applicable).
- The latest/first version shall be applicable for the students enrolling for B.E/B.Tech degree programs at this Institute from Academic year 2019 - 2020 and onwards.

2. PREAMBLE

The regulations prescribed herein have been made by KIT, an autonomous institution, approved by AICTE,New Delhi and affiliated to the Anna University, Chennai, to facilitate the smooth and orderly conduct of its academic programmes and activities at the B.E/B.Tech., level. It is expected that the regulations will enable the students to take advantage of the various academic opportunities at the Institute and prepare themselves to face the challenges in their professional careers ahead. It may be noted that:

a. The provision made herein shall be applicable to all the B.E/ B.Tech. programmes offered at the institute, at present;

b. They shall also be applicable to all the new B.E /B.Tech. programmes which may be started at the Institute in the future;

c. Academic and non-academic requirements prescribed by the Academic Council have to be fulfilled by a student for eligibility towards award of B.E/B.Tech. Degree.

3. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires :

Sl. No.	Name	Definition
1.	**Programme**	Refers to Degree Programme that is B.E./B.Tech. Degree Programme.
2.	**Discipline**	Refers to branch or specialization of B.E./B.Tech. Degree Programme, like Computer Science and Engineering, Mechanical Engineering etc.,
3.	**Course**	Refers to a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.,
4.	**Head of the Institution**	Refers to the Principal of the College.
5.	**Controller of Examinations (CoE)**	Refers to the authority of the college who is responsible for all activities of the Examinations.

6.	**Head of the Department (HoD)**	Refers to the Head of the Department concerned.
7.	**University**	Refers to Anna University, Chennai.
8.	**College (KIT)**	Refers to KIT-Kalaignarkarunanidhi Institute of Technology, Coimbatore.
9.	**Curriculum**	Refers to the various components/courses studied in each programme that provide appropriate outcomes (knowledge, skill and behavior/attitude) in the chosen branch of study.
10.	**T- P - TU - C**	Refers to Theory, Practical, TUtorial, and Credits respectively.
11.	**Humanities and Social Sciences (HS)**	Courses include English, Professional Ethics and Human Values, Communication skills etc.
12.	**Basic Sciences (BS)**	Courses include Mathematics, Physics, Chemistry, etc.,
13.	**Engineering Sciences (ES)**	Courses include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Civil / Computer Engineering etc.,
14.	**Professional Core (PC)**	Courses include the core courses relevant to the chosen specialization / branch.
15.	**Professional Elective (PE)**	Courses include the elective courses relevant to the chosen specialization / programme.
16.	**Open Elective (OE)**	Open Elective (OE) courses include the courses which a student can choose from the curriculum of other B.E. / B.Tech. programmes and courses offered by the Departments under the Faculty of Science and Humanities & Department of Management. These courses may be offered by internal/external experts.
17.	**Project Work (PW)**	Refers to the project done by a student or a group of students during final year.
18.	**Career Enhancement Courses (CEC)**	Includes Mini Project Work and/or Internship, Seminar, Professional Practices, Case Study, soft skills and Industrial / Practical Trainings etc.,

19.	**Academic Evaluation Committee (AEC)**	The committee includes Principal, CoE, HoD concerned (For details refer **Appendix V**)
20.	**Department Evaluation Committee (DEC)**	The committee included HoD (need basis), senior faculty member(s) of department from various levels, class advisor, Mentor of the students. (For details refer **Appendix V**)

4. ADMISSION

4.1 B.E. / B.Tech. Degree Programme (I Semester)

Candidates seeking admission to the first semester of the eight semester

The Candidates should have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

4.2 Lateral Entry Admission

i. The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. in the branch corresponding to the branch of study.

(OR)

ii. The candidates who possess the Degree in Science (B.Sc.,) (10+2+3 stream) with Mathematics as a subject at the B.Sc. Level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. Such candidates may be two additional Engineering subject(s) in the **third and fourth semesters** as prescribed by the AEC, if necessary.

4.3 Re - admission

Students, who have discontinued for reasons other than disciplinary action, may be readmitted as per guidelines given by DoTE, Government of Tamilnadu and Anna University. Department Evaluation Committee (DEC) shall study and recommend on the exemption and addition of courses to be registered for, by the student concerned during re-admission. The details shall be forward to Academic Evaluation Committee (AEC) for approval and the committee's decision shall be final.

5. PROGRAMMES OFFERED

B.E. / B.Tech. Programmes under the Faculty of Mechanical Engineering, Faculty of Electrical Engineering, Faculty of Information and Communication Engineering and Faculty of Technology. KIT offers 4 year (8 Semesters) B.E./B.Tech. Degree programme affiliated to Anna University, under Choice Based Credit System (CBCS) for students admitted from 2019 onwards in the following branches of Engineering and Technology as in Table 1.

Table 1. List of B.E. / B.Tech. programmes offered

B.E.	B.Tech
Aeronautical Engineering	Bio Technology
Agriculture Engineering	
Bio Medical Engineering	
Computer Science and Engineering	
Electronics and Communication Engineering	
Electrical and Electronics Engineering	
Mechanical Engineering	

6. ACADEMIC STRUCTURE OF PROGRAMMES

6.1 Medium of Instruction

The medium of instruction for the entire undergraduate programme will be English.

6.2 Categorization of Courses

Every B.E. / B. Tech. Programme will have a curriculum with syllabi consisting of theory and practical courses that shall be categorized as follows:

The typical curriculum structure for UG degree programmes are based on AICTE and Anna University and is given in Table 2.

Table 2: Curriculum Structure

Humanities and Social Sciences including Management Courses (HS)	Basic Sciences (BS)	Basic Engineering Sciences (ES)
Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)
Career Enhancement Courses (CEC)		

The course outcomes (CO's) are designed to align with the Programme Outcomes (PO's) and Programme Educational Objectives (PEO's) of the respective programmes.

In addition to the courses listed in the curriculum, the department can include elective courses offered by reputed Industry / Educational Institutions /Experts from time to time, approved by DEC/AEC and ratified by the Academic Council.

The credits earned through such courses shall be considered equivalent to Professional Elective (PE) credits or Open Elective (OE) credits as decided by the Department evaluation Committee (DEC) on a course to course basis.

Experts from the Industry / Institution may design such specialized elective courses based on the current technical skill requirements. The Department evaluation Committee (DEC) shall review and approve the course offered by the expert from the industry / Institution.

In addition to the courses that carry credits, all students are required to complete mandatory non-credit courses, if offered (eg.,Value education courses, and others).Credits will not be awarded but will be assessed and graded, and must be completed.

The following is the credit distribution of KIT based on the suggested AICTE distribution. (Table 3)

Table 3 : Credit Distribution

Category	Credit range
A - Foundation Courses	
Humanities and Social Sciences including Management Courses (HS)	6-9
Basic Sciences Courses (BS)	17-26
Basic Engineering Sciences (ES)	10-29
B - Professional Core Courses	
Professional Core Courses (PC)	62-87
C - Elective Courses	
Professional Electives (PE)	15-18
Open Electives (OE)	6-12
D - Project Work	
Project Work (PW)	11-13
E - Mandatory Courses Prescribed by AICTE/UGC	
Mandatory Courses (Induction Program, Environmental Sciences, Indian Constitution)	-
F - Career Enhancement Courses(CEC)	8
Total Credits	**165 - 174**

6.3 Number of courses per semester

Each semester curriculum shall normally have a blend of lecture courses not exceeding 8 and Laboratory courses and Career Enhancement Courses (CEC) not exceeding 7. However, the total number of courses per semester shall not exceed 15. The students can register for Professional Elective/Open Elective courses in any semester, starting from the third semester.

6.4 Credit Assignment

Each course offered is given a T-P-TU-C structure, depending on the number of lecture periods (T), number of periods for practical (P) and number of tutorial periods (TU) required per week for an efficient teaching - learning process. A student is expected to put-in his/her own efforts in proportion with periods spent in classroom, as defined in T-P-TU-C structure. On successful completion of the course a student is said to have earned a specified number of credits defined for each course. Each course is assigned certain number of credits based on the following table :

Table 4: Credit Assigned

Contact period per week	Credits
1 Lecture Period (**T** = Lectures given during class by the faculty)	1
1 Tutorial Periods (**TU** = Tutorial, also class based with more emphasis on problem solving)	1
2 Practical Period (**P**) (Laboratory Periods / CEC / Projects)	1

6.5 Career Enhancement Courses

6.5.1 Personality and Character Development

All students shall enroll, on admission, in any one of the personality and character development programmes (NCC / NSS / YRC) and undergo training and attends camp as prescribe by the respective officers/ coordinators. The training shall include classes on hygiene and health awareness and also training in first-aid.

National Cadet Corps (NCC) will have number of parades/camps specified by the NCC officer.

National Service Scheme (NSS) will have social service activities in and around the College / Institution.

Youth Red Cross (YRC) will have activities related to social services in and around College /Institutions. While the trainingactivities will normally be during weekends, the camp will normally be during vacation period.

6.5.2 Industrial Training / Internship

Students shall undergo industrial training/Internship if mandated in the curriculum for periods as specified in the curriculum during the summer/winter vacation, the training being taken on a continuous basis for the periods mentioned. The industry/organization is to be selected with the approval of the Department Evaluation Committee (DEC). Industrial training may also be referred to as “In-plant training”.

The Industrial Training / Internship shall carry 100 marks and shall be evaluated through CIA only. The credit will be awarded to the student after the submission of Internship / Training report to the HoD. The report will be evaluated by a team of (DEC) faculty members nominated by the HoD for awarding the Credit. Based on the recommendation by the team, the student will be awarded credits and the results will be sent to the Controller of Examinations. The awarded credit will taken for CGPA calculation. The final year project period at industry / research organization will not be considered as industrial Training / internship.

6.5.3 Industrial Visit

Every student is required to go for at least one Industrial Visit every year starting from the second year of the Programme subject to the approval of the Head of the Department and Principal. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

6.5.4 Professional Certificate Courses

Students have to undergo one credit courses offered by experts from industry / research organizations and approved by academic council. Students can register such courses from his / her second year of study as and when these courses are conducted by the departments. A student is also permitted to register for these courses of other departments.

If a student does not successfully complete the registered industry supported one credit courses in a semester, the registration of that course will be considered as cancelled. Further, it will not be treated as arrear and if he/she wishes, he/she can re-register for the same course in the ensuing semesters and successfully complete it as and when it is offered subsequently.

6.5.5 Online Courses

Students may be permitted to register for online courses (which are provided with certificate after evaluation of the performance, SWAYAM / NPTEL), during third to sixth semester of his / her study. On successful completion of the course, he / she has to submit the copy of the certificates to the Head of the Department. The assemment will not be calculated for CGPA.

6.5.6 Soft Skills

Every Student is required to go for two soft skill courses during first year of study. The soft skill course includes the communication skill, interpersonal skill and career development courses. One credit will be awarded for each soft skills courses and it will be included for SGPA/CGPA calculations.

6.5.7 Career Ability Course

The career Ability courses will be designed by the respective department with approval from DEC/AEC based on the industry requirements. One credit will be awarded for each soft skills courses and it will be included for SGPA / CGPA calculations.

6.5.8 Evaluation of One Credit Courses

Students can register for one credit courses in any semester when it is offered. Experts from the industry / Institution (KIT) may design such specialized one-credit courses based on the current technical skill requirements. The Department Evaluation Committee (DEC) shall review and approve the syllabus, course plan, and pedagogy and assessment pattern for the course. One credit courses can also be offered by internal experts i.e faculty members from other departments (not belonging to the specific discipline of the programme) also can offer such courses to the students with the approval of DEC.

A one - credit course shall carry 100 marks and shall be evaluated through Continuous Internal Assessment (CIA) only. The QP pattern and scheme will be decided by the course faculty and will be approved by the DEC/AEC.

The Head of the Department may identify a faculty member as the coordinator for the course. A committee consisting of the Head of the Department, faculty handling the course (if available), coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process.

The grades shall be assigned to the students by the above committee based on their performance and included in the calculation of CGPA.

6.5.9 Industry Supported Project Work

The students satisfying the following conditions shall be permitted to carry out their final semester Project work for six months in industry/research organization.

The student should not have current arrears and shall have CGPA of 8.0 and above until 5th semester. The student shall undergo the eighth semester courses in the sixth and seventh semesters. The Head of Department, in consultation with the faculty handling the said courses shall forward the proposal recommended by the Principal to CoE after approval from AEC at least four weeks before the commencement of the sixth semester of the programme.

6.6 Course Numbering Scheme

Each course is denoted by a unique code consisting of 9 alphanumeric characters. The details of the numbering scheme are in APPENDIX A.

6.7 Credit Requirement for Programmes

The total number of credits that a student earns during the period of study is called the total credits. For the successful completion of the B.E/B.Tech programme, a regular student must earn 165 - 174 credits (varies with the programme) in minimum of eight semesters, while a lateral - entry student must earn 122 - 131 credits in a minimum of six semesters.

7 DURATION OF THE PROGRAMMES

7.1 The duration for the B.E./B.Tech. degree programmes shall extend over a period of 4 years (8 semesters) for the students admitted in the first semester but in any case not more than 7 years (14 semesters) and 3 years (6 semesters) for the students admitted in third semester (Lateral Entry Scheme) and not more than 6 years (12 semesters).

7.2 Each semester normally consists of 90 working days, including test and examination days. In any contingent situation, the number of working days per semester shall not be less than 65 days. The Principal is given the discretionary powers to decide the number of working days.

In such contingencies, the Principal shall ensure that every faculty member teaches the full content of the specified syllabus for the course being taught.

7.2.1 Due to Pandemic / Abnormal situations the Scheme of Examinations and Evaluation will be followed as per the guidelines issued by the Government of Tamil Nadu and Anna University, Chennai.

7.3 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 7.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

7.4 For the purpose of regulations, the academic year will be divided into two semesters, the odd semester normally spanning from June to November and the even semester from December to May.

8. COURSE REGISTRATION

Each student, on admission shall be assigned to a mentor who shall advice and counsel the student about the details of the academic programme and choice of courses, considering the student's academic background and career objectives. Some courses require students to register through a course registration process via online.

8.1 Course Registration

Each student on admission shall register for all the courses prescribed in the curriculum in the students first semester of the study.

The registration process for the courses offered in the online registration mode in the forthcoming semester, will commence preferably 10 working days prior to the last working day of the current semester.

A department shall offer a course only if a minimum number of students register for that course. This minimum number may vary from course to course and shall be specified by the department from time to time.

After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Internal Assessment Marks and appear for the End Semester Examination (ESE) or as specified in the curriculum.

8.2 Credits details for Course Registration

A student has to earn the total credits specified in the curriculum of the respective programme of study, in order to be eligible to obtain the degree. However, if the student wishes, then he/she is permitted to earn more than the total number of credits prescribed in the curriculum.

The number of credits, most students are expected to register for, in a semester, will be about 20 - 30 credits (excluding arrears). so that they complete the programme within the specified duration of the programme. The minimum credits a student can register for, in a regular semester shall be 12 and the maximum credit a student can register is 36 (excluding arrears). Students shall register for project work in the 7^{th} and 8^{th} semester or 8^{th} semester only.

8.3 Flexibility to Add / Drop courses

A student can add or drop the courses registered within the first 5 instructional days, from the commencement of a regular semester, subject to the availability of resources and the minimum / maximum number of credits required to be registered in a semester vide clause 8.2.

From semester 3 to 8, the student has the options for Adding/dropping an existing course. The total number of credits that a student can add/drop is limited to 6. Practical courses cannot be added / dropped.

8.4 Reappearance Registration

8.4.1 If a student fails in a theory or practical course, the student shall do reappearance registration for that course in the subsequent semester by retaining the Continuous Internal Assessment Marks already earned.

8.4.2 If the theory course, in which the student has failed, is a Professional Elective or an Open Elective, the student may register for the same or any other Professional Elective or Open Elective course respectively in the subsequent semesters. Such changes can be done only with due approval by DEC.

8.4.3 The student who fails in Project work/ Seminar other than Practical courses shall register for the same in the subsequent semester and reappear for the End Semester Examination.

8.4.4 If a student is not eligible to appear for End Semester Examination of a course due to lack of attendance, the student has to register for that course again, when offered next, attend the classes and fulfill the attendance requirements. If the course, in which the student has lack of attendance, is an elective, the student may register for the same or any other elective in the subsequent semesters.

8.4.5 If a student has completed the 8 semesters and has obtained RA grade in one or more courses, he can register and appear for arrear examination directly whenever conducted next.

8.4.6 A student who has already appeared for a course in a semester and passed the examination is not entitled to reappear the same course for improvement of Grade/ Marks.

9. REQUIREMENTS FOR APPEARING FOR CIA, ESE

9.1 A student who has fulfilled the following conditions shall be deemed to be eligible to appear for the CIA-1, CIA-2, CIA-3 and ESE. Ideally, every student is expected to attend all the classes and earn 100% attendance. Students who have earned not less than 75% attendance course wise taking into account the number of periods required for that course as specified in the curriculum. Table 5 illustrates the mandatory attendance requirement for CIA-1, CIA-2, CIA-3 and ESE.

Table 5 : Mandatory Attendance Requirement for CIA - 1, CIA - 2, CIA - 3 and EEE.

Test / Examination Type	Period of Calculation	Minimum % of attendance required
Continuous Internal Assessment Test - 1 (CIA-1)	**First Semester** From the date of joining of course to three working days before the start of CIA - 1	60%
	Second to Eighth semester From the date of commencement of the class to one week before the start of CIA - 1	75%
Continuous Internal Assessment Test - 2 (CIA-2)	From the date of joining (1stsemester) / date of commencement of class (2nd to 8th Semester) to one week before the start of CIA - 2	75% (for students maintaining 80% or more attendance between CIA 1 and CIA-2, but falls short of the 75% cumulative requirement, the requirement may be relaxed if recommended by the AEC)
Continuous Internal Assessment Test - 3 (CIA - 3)	From the date of joining (1^{st} semester)/date of commencement of class (2^{nd} to 8^{th} Semester) to one week before the start of CIA - 3	75% (for students maintaining 80% or more attendance between CIA-2 and CIA 3, but falls short of the 75% cumulative requirement, the requirement may be relaxed if recommended by the AEC)
End Semester Examination (ESE)	From the date of joining (1^{st} semester) / date of commencement of class (2^{nd} to 8^{th} Semester) to the last day of instruction.	75%

9.1.1 Students having a CGPA of 8.50 and above and with no standing arrears will be exempted from the minimum attendance requirements (from 7th Sem. onwards).

9.1.2 A student shall normally be permitted to appear for End Semester Examination of the course if he / she has satisfied the attendance requirements (vide Clause -9.1). He /she is eligible to register for ESE in that semester by paying the prescribed fee.

9.1.3 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester. Ideally every student is expected to attend all classes of all the courses and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports, the student is expected to attend atleast 75% of the classes. Therefore, he/she shall secure not less than 75%.

9.1.4 However, a candidate who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / Participation in Sports events may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate attested by the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.

9.1.5 Candidates who secure less than 65% overall attendance and candidates who do not satisfy the clause 9.1.3 and 9.1.4 shall not be permitted to write the semester examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

9.1.6 The students who are consistently good in academics ONLY be considered for the grant of ODL under Co-curricular activities by the competent authorities. The following activities shall be considered for the sanction of ODL;

- Sports and Games: TIES, Inter Collegiate, Inter Zonal, Inter University, State Level, National Level and Open Tournaments.
- NCC: Camps and expeditions, NSS camps
- Cultural Programme at State, National and International Level
- Seminar / Symposia: Paper presentation/Quiz
- Leadership courses organized by other organizations & Alumni Association activities, Association activities, Placement activities.
- Training programs/Internship at industries and Higher learning Institutions
- Personal damage incurred during the extracurricular activities
- The ODL requisition letter shall be forwarded to the Principal through the HoD of the student by the staff-in-charge of the respective activities before completion of every activity.

- The ODL sanctioned letters shall be submitted to the Department Office. The faculty-in-charge of the department office will check the eligibility for the award of attendance at the end of semester and the same may be submitted to DEC for approval.

9.1.7 The student should register all the courses of current semester and all the arrear courses in the previous semesters. If any student fails to register and pay the examination fees within the due date, he/she shall not be permitted to attend the End Semester Examinations. However, he/she will be permitted to continue their studies in the next higher semester, provided that the student satisfies the requirements as stipulated in this clause of this regulation.

9.1.8 Those students who are not deemed to have completed the semester with references to the conditions specified above shall undergo the semester again in all the courses in the respective semester during next academic year. He/she shall seek re-admission as per the norms of the affiliating University/DOTE (Directorate of Technical Education). The days of suspension for a student on disciplinary grounds will be considered as days of absence for calculating the percentage of attendance for each individual course.

10. PROVISION FOR WITHDRAWAL FROM EXAMINATION

A student may, for valid reasons (medically unfit / unexpected family situations/Sports person representing Tamilnadu / India with prior permission for participation from Principal / CoE / DEC), be granted permission to withdraw (after registering for the examinations) from appearing for any course or courses in the End Semester Examination of a particular semester. The student may withdraw by following the due process of the CoE's office before the commencement of examination. This facility can be availed only once during the entire duration of the degree programme.

Withdrawal from ESE will be valid only if the student is, otherwise, eligible to write the examination and the application for withdrawal is made to the CoE, prior to the examination in the course or courses concerned. The application for withdrawal should be recommended by the Head of the Department concerned and approved by the Head of the Institution.

11. TEMPORARY BREAK OF STUDY FROM A PROGRAMME

11.1 Break of study is normally not permitted. However, if a student intends to temporarily discontinue the programme in the middle of a semester / year for valid reasons (such as Internships, accident or hospitalization due to prolonged ill health) and wishes to re-join the programme in the next academic year, he / she shall apply in advance to the Principal through the Head of the Department, stating the reasons. The application shall be submitted not later than the last date for registering for the semester examinations. Break of study is permitted only once during the entire period of the degree programme.

11.2 The student permitted to re-join the programme after the break shall be governed by the rules and regulations in force, at the time of re-joining.

11.3 The duration specified for passing all the courses for the purpose of classification of degree(vide clause 19) shall be increased by the period of such break of study permitted(vide clause 11)

11.4 If a student is detained for want of requisite attendance, academic progress and good conduct, the period spent in that semester shall not be considered as permitted Break of Study and Clause 11.3 is not applicable for such cases.

12. ASSESSMENT PROCEDURES FOR AWARDING MARKS

The total marks for each course generally (Theory, Practical, Project Work) will be 100, comprising of two components namely Continuous Internal Assessment (CIA) and End Semester Examination (ESE). However, there could be some open elective courses, human excellence courses, one credit industry courses, add-on courses and Mandatory courses that have only continuous assessment for 100 marks without an End Semester Examination. The Department Consultative Committee (DCC) has to approve such courses every semester. The scheme of assessment may also be decided by the faculty handling the course concerned with the approval from DCC and shall be made available to the students during the online course registration. Each course shall be evaluated for a maximum of 100 marks as illustrated in **Table - 6.**

Table - 6 : Course Evaluation

<table>
<tr><th>S. No.</th><th>Category of course</th><th>Continuous Internal Assessment</th><th>End Semester Examinations</th></tr>
<tr><td>1.</td><td>Theory Courses</td><td rowspan="3">40 Marks</td><td rowspan="3">60 Marks</td></tr>
<tr><td>2.</td><td>Laboratory Courses</td></tr>
<tr><td>3.</td><td>Project Work</td></tr>
<tr><td>4.</td><td>CCA (Technical Seminar / Soft Skill / Industry oriented one credit courses)</td><td>100 Marks</td><td>-</td></tr>
</table>

The End Semester Examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.

The End Semester Examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner and an internal examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the supervisor of the project group and an internal examiner.

For the End Semester Examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the Controller of Examinations.

13. MARKS DISTRIBUTION

13.1 Attendance Mark

Marks are awarded for the attendance earned by the students for individual courses as per the following table.

Attendance Range in %	Marks to be earned by the students
96 - 100	5
91 - 95	4
86 - 90	3
81 - 85	2
75 - 80	1

13.2 Question paper pattern

a. Table 7.1 Continuous Internal Assessment (CIA 1, CIA -2 and CIA-3)

2 Marks	12 Marks	Total marks
7	3 (3 out of 5)	50

b. Table 7.2 End Semester Examinations

<table>
<tr><th>2 Marks</th><th>13 Marks</th><th>15 marks</th><th>Total Marks</th></tr>
<tr><td>10</td><td>5
(Either or Type)</td><td>1
(Either or Type)</td><td>100</td></tr>
<tr><th colspan="4">For Mathematics paper only</th></tr>
<tr><td>2 Marks</td><td colspan="2">16 Marks</td><td>Total Marks</td></tr>
<tr><td>10</td><td colspan="2">5</td><td>100</td></tr>
<tr><th colspan="4">For Engineering Graphics only</th></tr>
<tr><td colspan="3">20 Marks</td><td>Total Marks</td></tr>
<tr><td colspan="3">5</td><td>100</td></tr>
</table>

13.3 Theory Courses

Continuous Internal Assessment tests are conducted by the Office of the Controller of Examination. Continuous Internal Assessment comprises three Continuous assessment tests, Assignment / Class test / Presentation / Online Test / Mini projects / Tutorials and Attendance. By adopting this method, the students will go through a continuous and systematic study pattern. The Corresponding weightages are given below.

Table 8 : Continuous Internal Assessment Test for UG Theory Courses

Particulars	Syllabus	Duration	Exam Mark	Internal Mark
Continuous Internal Assessment 1	1.5 Units	1.5 hours	50 marks	10
Continuous Internal Assessment 2	1.5 Units	1.5 hours	50 marks	10
Continuous Internal Assessment 3	1.5 Units	1.5 hours	50 marks	10
Assignment / Class Test / Online Test / Mini Project / Tutorial / Presentation/ Online course/Certificate Course				5
Attendance				5
Total				40

13.4 CRITERIA FOR ASSESSMENT FOR LAB COURSES

Every exercise / experiment in all practical courses shall be evaluated on a continuous basis. The criteria for Continuous Assessment (for each cycle of exercise/experiment) are given in Table 9

Table 9 : Assessment for Lab Courses

Sl. No.	Description		Weightage
1.	Continuous Internal Assessment Marks (CIAM)		
	a.	Average of Experimental Report / Workbook	25
	b.	Model examination	10
	c.	Attendance	5
	Total CIAM		**40**
2.	End Semester Exam Marks (ESEM)		
	a.	Lab Examination with Viva Voce	60
	Total ESM		**60**
		Total Marks	**100**

13.5 PROJECT WORK

For final year Project Work out of 100 marks, the maximum marks for Continuous Assessment is 40 marks and that for the End Semester Examination (project report evaluation and viva-voce examination) is 60 marks. Project work may be assigned to a single student or to a group of students not exceeding 4 per group, under the supervision of faculty guide(s).

The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three faculty members in the review committee. There shall be three reviews (as per **Table - 10**) in total, during the semester by a review committee. The student shall make presentation on the progress made before the committee.

Interim project report shall be submitted before the project reviews with the approval of the guide. The Project Report, prepared according to the approved guidelines and duly signed by the guide and the Head of the Department, shall be submitted to the department as per the timeline announced by the department. The End Semester Examination for project work shall consist of evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted separately for each student, by a committee consisting of the external examiner, and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work.

The Continuous Internal Assessment Marks (CIAM) and End Semester Examinations Marks (ESEM) for Project Work and the Viva-Voce Examination will be distributed as indicated in **Table - 10**.

Table - 10 : CIAM and ESEM break-up for project work

Sl.No.	Review No.		Description	Marks	Total Marks
1.	**Continuous Internal Assessment Marks**				
	a.	Review 1	Review Committee	5	10
			Guide	5	
	b.	Review 2	Review Committee	7	15
			Guide	8	
	c.	Review 3	Review Committee	7	15
			Guide	8	
Total CIAM					**40**
2.	**End Semester Examinations Marks**				
	a.	Evaluation of final report and viva-voce	Internal Examiner	10	**50**
			External Examiner	40	
	b.	Outcome*	Publication of papers / prototype / patents etc.,	10	10
Total ESEM					**60**
Total Marks					**100**

Review committee consists of internal faculty members nominated by the Head of the Department. The guide of student being examined shall not be part of the committee.

* Outcome - in terms of paper publication, patents, product development and industry projects shall be awarded by both internal and external examiners, based on the document proofs submitted by the student concerned.

If a student fails to submit project report / does not appear for the ESE /fails in the End Semester Examination (ESE), he/she is deemed to have failed in the project work and shall have to re-register for the same when offered next.

14. PASSING REQUIREMENTS

14.1 A student is declared to have successfully passed a theory based course if he / she has secured:

- A minimum of 45% marks in the End Semester Examinations.
- A minimum of 50% marks on combining both Continuous Internal Assessment Marks (CIAM) and End Semester Examination Marks (ESEM).

14.2 A student is declared to have successfully passed a practical / project based course if he/she has secured :

- A minimum of 45% marks in the End Semester Examinations.
- A minimum of 50% marks on combining both Continuous Internal Assessment Marks (CIAM) and End Semester Examination Marks (ESEM).

14.3 For a student who does not meet the minimum passing requirements, the term “RA” against the course will be indicated in his/her grade sheet. He/she shall reappear in the subsequent examinations for the course as arrear or re-register for the course when offered .

14.4 For a student who is absent for end-semester theory / practical / project viva-voce, the term “RA” will be indicated against the corresponding course. He/she shall reappear for the End Semester Examination of that course as arrear in the subsequent semester or when offered next.

14.5 The letter grade “W” will be indicated for the courses for which the student has been granted authorized withdrawal (refer Clause 10).

14.6 For mandatory courses (non-credit), the student must satisfy the minimum attendance requirement & passing criteria as specified for the course as detailed in Section 16.2.

15. METHODS FOR REDRESSAL OF GRIEVANCES IN EVALUATION

Students who are not satisfied with the grades awarded in the End Semester Examination of Theory for regular and arrear exams can seek redressal as illustrated in Table 11.

Table - 11 : Grievance Redressal Mechanism

Sl. No.	Redressal Sought	Methodology	
		Regular Exam	Arrear Exam
1.	Revaluation	Apply for photo copy of answer book Then apply for revaluation after course expert recommendation	
2.	Challenge of Evaluation	Apply for photo copy of answer book Then apply for revaluation after course expert recommendation Next apply for challenge of evaluation	
Note: All applications to be made to COE along with the payment of the prescribed fee.			

Challenge of Evaluation - Flow Process

Table - 12 : Evaluation - Flow Process

Step 1	A student can make an appeal to the CoE for the review of answer scripts after paying the prescribed fee
Step 2	CoE will issue the photocopy of answer scripts to the student
Step 3	The faculty who had handled the subject will evaluate the script and HoD will recommend
Step 4	A committee consisting of 2 evaluators appointed by CoE will review and declare the result
Step 5	If the result is in favour of the student, the fee collected will be refunded to the student
Step 6	The final mark will be announced by CoE.

16. LETTER GRADE

Absolute grading system is adopted in converting marks to grads

16.1 Absolute Grading Policy

All assessments of a course will be evaluated on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Table - 13 : Absolute Grading - Letter Grade and its Range

Sl.No.	Range of percentage of total marks	Letter Grade	Grade Points
1.	91 - 100	O (Outstanding)	10
2.	81 - 90	A+ (Excellent)	9

3.	71 - 80	A (Very Good)	8
4.	61 - 70	B+ (Good)	7
5.	50 - 60	B(Average)	6
6.	<50	RA (Re-appearance)	0
7.	Shortage of Attendance	RA (Re-appearance due to shortage of attendance)	0
8.	Absent	RA (Re-appearance due to absence	0
9.	Withdrawal from examination	W	0
10.	Pass in Mandatory non-credit courses	P	0
11.	Fail in Mandatory non-credit courses	F	0

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: “O”, “A+”, “A”, “B+”,“B”. ‘RA’ indicates that Reappearance is mandatory for that course concerned. ‘SA’ denotes shortage of attendance (as per Clause 9) and hence prevented from writing the End Semester Examination. P and F are grades for mandatory, but non-credit courses.

16.2 Grading for Mandatory Courses

Mandatory Courses are courses that are required to be completed to fulfill the degree requirements (e.g. Human excellence, Environmental science, etc.). They are normally non - credit based. These courses will not be taken in to consideration for the SGPA / CGPA calculations. Each of these courses is assessed continuously and internally for a total mark of 100. The pass mark is 50%. Students, who fail to pass this course, are required to repeat the course, when offered next.

16.2.1 For Mandatory non-credit courses the student must satisfy the minimum attendance requirement & passing criteria as specified for the course. These courses do not carry credits but needs to be completed to fulfill the degree requirements.

16.2.2 For the Mandatory non-credit courses student completing the course will be awarded Pass grade (P) and those who fail to satisfy the attendance requirement or fail to satisfy the minimum passing requirement of 50% marks, will be awarded Fail (F) grade and the student must re-register for the course when it is offered next.

16.2.3 Grade Sheet

After the results are declared, grade sheets will be issued to each student, which will contain the following details:

- The College Name and Affiliating University.
- The list of courses registered during the semester and the grades scored.
- The Semester Grade Point Average (SGPA) for the semester.
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

On completion of a semester, each student is assigned a Semester Grade Point Average which is computed as below for all courses registered for, by the student during that semester.

$$\text{Semester Grade Point Average} = \frac{\sum (C_i \times GP_i)}{\sum C_i}$$

where C_i is the credit for a course in that semester and GP_i is the Grade Point earned by the student for that course. The **SGPA** is rounded off to two decimals.

The overall performance of a student at any stage of the Degree programme is evaluated by the **C**umulative **G**rade Point **A**verage **(CGPA)** up to that point of time.

$$\text{Cumulative Grade Point Average} = \frac{\sum (C_i \times GP_i)}{\sum C_i}$$

where C_i is the credit for each course in each of the completed semesters at that stage and GP_i is the grade point earned by the student for that course. The **CGPA** is rounded off to two decimals.

16.2.4 FORMULA FOR CALCULATING PERCENTAGE

CGPA x 10 = % of Marks

17. ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided the student has

i. Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.

ii. Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 8 semesters within a maximum period of 7 years and 6 years in the case of Lateral Entry reckoned from the commencement of the first (third in the case of Lateral Entry) semester to which the candidate was admitted.

iii. Successfully passed any additional courses prescribed by the Academic council

iv. Successfully completed the NCC / NSS / NSO / YRC requirements.

v. Successfully passed any additional courses prescribed by the Department & concerned whenever readmitted under regulations 2019 (R19) (vide Clause 4.3)

vi. No disciplinary action pending against the student.

vii. The award of Degree must have been approved by the Academic Council of KIT.

18. CLASSIFICATION OF B.E. / B.TECH DEGREE

The degree awarded to eligible students will be classified as given in **Table 14.**

Table - 14: Classification of the B.E. / B.Tech. Degree

Sl.No.	Class Awarded	Criteria
1.	First class with distinction	A student who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction: ⊙ Should have passed the examination in all the courses of all the 8 semesters and 6 semesters in the case of Lateral Entry) in the student's First Appearance within five years and Four years in the case of Lateral Entry).
		⊙ Withdrawal from examination will not be considered as an appearance. ⊙ Should have secured a CGPA of not less than 8.50. ⊙ One year authorized break of study (if availed of) is included in the five years and (four years in the case of lateral entry) for award of First class with Distinction. ⊙ Should NOT have been prevented from writing End Semester Examination due to lack of attendance in any semester.
2.	First Class	A student who satisfies the following conditions shall be declared to have passed the examination in **First class :** ⊙ Should have passed the examination in all the courses of all eight semesters and 6 semesters in the case of Lateral Entry) **within Six years**. and Five years in the case of Lateral Entry). ⊙ One year authorized break of study (if availed of) or prevention from writing the End Semester Examination due to lack of attendance (if applicable) is included in the duration of six years and five years in the case of lateral entry) for award of First class. ⊙ Should have secured a CGPA of not less than **7.00**.

3.	Second Class	All other students (not covered in clauses Sl.No.1 and 2 under clause 18) who qualify for the award of the degree (vide Clause 19) shall be declared to have passed the examination in Second Class.
Note : A student who is absent for the End Semester Examination in a course / project work Viva Voce after having registered for the same will be considered to have appeared for that examination (except approved withdrawal from End Semester Examinations as per Clause 9) for the purpose of classification.		

19. AWARD OF DEGREE

The Academic Council of the institution will approve the award of Degree to all eligible students. The degree will be issued by Anna University, Chennai and the consolidated Grade Sheet will be issued by the institution. The consolidated grade sheet will specify any specializations and distinctions that the student has earned during the course of the study.

20. FACULTY MENTOR

To help the students in palnning their courses of study and for general advice on the academic progarmme, the Head of the Department will attach a certain number of students (maximum 25) to a faculty member of the department. He/She shall function as Faculty Mentor for these students throughout their period of study. The faculty mentor shall,

- Advice the students in registering and reappearance registering of courses
- Monitor their attendance, academic progress and discipline of the students
- Counsel periodically or during the faculty mentor meeting scheduled in the class time table.
- Inform the students about the various facilities and activities available to enhance the student's curricular and co-curricular activities.
- If necessary, the faculty mentor may also discuss with or inform the parents about the progress of the students through Head of the Department or in Parent-Teacher meeting.

21. CLASS COMMITTEE

The objective of the Class Committee is to improve the teaching-learning process.

The functions of the class committee include:

- Resolving difficulties experienced by students in the classroom and in the laboratories.
- Clarifying the regulations of the degree programme and the details of rules therein.
- Discussing the progress of academic schedule and deviations if any.
- Evaluating the performance of the students of the class after each test and finding the ways and means of improvement.
- Every class in first year of study shall have a class committee consisting of faculty members who are teaching in that class, student representatives (cross section of students from boys and girls) and a chairperson who is a faculty not handling the course for the class.

- From III semester onwards, Class committee comprises of all the faculty members who are handling courses in that particular semester and two student representatives from each course. A chairperson who is a faculty not handling course for that particular semester, nominated by the Head of the Department shall coordinate the activities of this committee.
- The class committee shall be constituted by the Head of the Department/Chief Tutor on the first week of commencement of the semester.
- The class committee shall meet three times in a semester as specified in the academic calendar.
- The Principal may participate in any class committee of the institution.
- During these meetings, the representative of the class shall meaningfully interact and express the opinions and suggestions of the other students of the class to improve the effectiveness of the teaching-learning process.
- The Chairperson is required to prepare the minutes of the meeting, signed by the members and submit the same to Head of the Department within five working days of the meeting. Head of the Department will in turn consolidate and forward the same to the Principal, within 10 working days of the meeting.
- In each meeting, the action taken report of the previous meeting is to be presented by the Chairperson of the class committee.

22. COMMON COURSE COMMITTEE

- A theory course handled by more than one teacher shall have a “Common Course Committee” comprising of all teachers teaching that course and few students who have registered for that course. There shall be two student representatives from each batch of that course. One of the teachers shall be nominated as Course Coordinator by the HoD concerned and duly approved by the Principal
- The first meeting of the Common Course Committee shall be held within fifteen days from the date of commencement of the semester. The nature and weightage of the continuous assessments shall be decided in the first meeting, within the framework of the Regulations. Two or three subsequent meetings in a semester may be held at suitable intervals. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to the whole batch.
- In addition, the “Common Course Committee” (without the student representatives) shall meet to ensure uniform evaluation of continuous assessments after arriving at a common scheme of evaluation for the assessments.
- Wherever feasible, the common course committee (without the student representatives) shall also prepare a common question paper for the continuous assessment tests. The question paper for the End Semester Examination is common and shall be set by the Course Coordinator in consultation with all the teachers or the external member as appointed by the Controller of Examinations.

23. DETAILS OF FACULTY PEDAGOGICAL AND STUDENT ASSESSMENT RECORD

Every teacher is required to maintain a Faculty Record Book/ course file consisting of the following details as shown below;

- Time-table, course syllabus, program outcomes, course outcomes.
- Details of attendance of each student marked in each theory/practical/project work class.
- CIA marks,Details of Assignment/ seminar given, course delivery details, corrective and preventive actions on test performance of students and any other additional details.

The record book should be submitted to the HOD periodically (at least three times in a semester) for checking the syllabus covered, the test marks and attendance. The HOD shall put his/her signature and date in the record book after due verification. At the end of the semester, the record book shall be verified by the Principal who will also ensure safe custody of the document for at least four years. The university or any inspection team appointed by the University / UGC / AICTE may verify the records of attendance and assessment of both current and previous semesters.

24. DISCIPLINE

Every student is required to maintain discipline and decorum both inside and outside the institution campus. They shall follow all the rules and regulations and should not indulge in any activity which can tarnish the reputation of the University or Institution. The Principal shall refer any act of indiscipline by students to the Discipline and Welfare Committee and other appropriate committees for action.

25. REVISION OF REGULATIONS AND CURRICULUM

The institution may from time to time revise, amend or change the Regulations,scheme of Examinations and syllabi, if found necessary. Academic Council assisted by Board of Studies and Standing Committee will make such revisions / changes.

Note : Any ambiguity in interpretation of this regulation is to be put up to the Standing Committee, whose decision will be final.

26. SPECIAL CASES

In the event of any clarification in the interpretation of the above rules and relations, they shall be referred to the Standing Committee. The standing committee will offer suitable interpretations/clarifications/ amendments required for special case on such references and get them ratified in the next meeting of the Academic Council. The decision of the Academic Council is final.

ANNEXURE - I

COURSE NUMBERING SCHEME

<table>
<tr><td>B</td><td>1</td><td>9</td><td>M</td><td>E</td><td>T</td><td>7</td><td>0</td><td>9</td></tr>
<tr><td>Programme</td><td colspan="2">Regulation</td><td colspan="2">Department Code</td><td>Course Type</td><td>Semester</td><td colspan="2">Sequence Number</td></tr>
</table>

Programme :	**Course Type**
Bachelor Degree (B.E. / B.Tech) - B	T - Theory
Masters Degree (M.E. / M.Tech) - M	P - Practical / Project/ Internship
Regulation :	E - Elective
R - 19	O - Open Elective
Department Code	C - One Credit Courses
AE - Aeronautical Engineering	N - Online courses
AG - Agricultural Engineering	S-Special Electives
BT - Bio Technology	
BM - Bio Medical Engineering	**Semester**
CS - Computer Science and Engineering	1 - First Semester
EC - Electronics and communication Engineering	2 - Second Semester
	3 - Third Semester
EE - Electrical and Electronics Engineering	4 - Fourth Semester
ME - Mechanical Engineering	5 - Fifth Semester
CA - Computer Application	6 - Sixth Semester
MB - Management Studies	7 - Seventh Semester
CH - Chemistry	8 - Eighth Semester
EN - English	
PH - Physics	**Sequence Number**
MA - Mathematics	00-99
MC - Mandatory Course	
CE - Career Enhancement	

ANNEXURE - II

POLICY ON MALPRACTICES

GENERAL

- It shall be the endeavour of all concerned to prevent, control and take remedial action to bring about the occurrences of malpractices to “Zero” in Examinations (both Internal and External), Assignments and in all Academic class works.
- Therefore, a comprehensive approach to the malady of malpractices has to be adopted to create a mindset of integrity and honesty, and at the same time take sufficiently stern action to make it clear that such attempts are fraught with comparably very high risk.
- In keeping with this stance, the following measures are to be taken by all concerned from class room level to the Examination Halls:

A. PREVENTION (This is the best method of tackling this malady)

a. Class room level:

All faculty members are to involve themselves in a psychological growth of students by personal example and self-respect and strive towards

- Developing a sense of honour in the minds of students so that they look down upon earning undeserved marks.
- Imbibing a sense of self-respect and internal dignity that prevents him/her from succumbing to the temptation of easy marks by cheating.
- Generating an awareness of the risks to their character and career if convicted, while also explaining the process and strict rules and regulations adopted by the educational system to prevent malpractices.
- Taking stern view of copied assignments and attempts at malpractices in internal examinations also merits equal seriousness as external examinations.
- Setting sufficiently strong deterrent rules in place and regulations like intimation to parents and warning to students in the presence of parents etc. even in case of efforts at malpractices in internal tests and/or repeated acts despite warnings in case of assignments also.

Examination Halls

Detailed instructions on Invigilation, question paper setting and evaluation and such other instructions will be issued for Invigilation, vigilance, which are to be brought to the notice of all students prior to the examinations.

B. PENAL ACTION FOR MALPRACTICES

All instances of malpractices will be forwarded to the Principal/ Chief Superintendents. The offences will be investigated by a Standing Enquiry Committee constituted by Principal, The committee is to summon and give the student an opportunity to present / plead his/her case. The Committee may also summon anybody else, if it so deems necessary for the conduct of enquiry, in the interest of proper investigation and dispensation of the case. The tenure of the committee would be a complete Academic year.

The Committee is to be guided by the following :

- The seriousness of the malpractice, in terms of deviousness, and culpability/ criminality of motive
- The seriousness in terms of effort and degree of deviousness and culpability / criminality of effort
- Any FIR / Police case that has been registered in the first instance by the Principal/ Chief Superintendent
- Any other special consideration either mitigating or to the contrary.

C. PENALTY FOR OFFENSES

The penalties awarded will depend on the seriousness of the Offence. A list of Offences and penalties are placed at Annexure III.

The Enquiry Report with findings and recommendations of the Committee are to be forwarded to the Controller who will undertake necessary follow up action. Based on the recommendations of the Controller of Examinations, the Principal is empowered to award penalties for offences classified as belonging to categories 1 to 7 of the offence table. The cases falling in categories from S.No. 8 onwards are to be put up to the Principal for consideration and award of suitable penalty.

ANNEXURE - III

SI.No.	Nature of Malpractice	Maximum Punishment
1.	Appeal by the candidate in the answer script to show mercy by way of awarding more than deserving marks.	Fine of Rs. 1000/- per subject.
2.	The candidate writing his/her name in the answer script.	
3.	The candidate writing his/her registration number/college name in places other than specified in the answer script	
4.	Any special marking in the answer script by the candidate.	
5.	The candidate communicating with neighbouring candidate orally or non- verbally; the candidate causing suspicious movement of his/her body.	
6.	Irrelevant writing by the candidate in the answer script.	
7.	The candidate writing answer on his/her question paper or making use of his/her question paper for rough work	
8.	The candidate possessing cell phones / programmable calculator(s)/any other electronic storage device(s) **gadgets**	Invalidating the examination of the particular subject written by the candidate
9.	The candidate possessing cell phones/ programmable calculator(s)/any other electronic storage device(s) **gadgets**	Invalidating the examination of the particular subject written by the candidate

<table>
<tr><td>10.</td><td>The candidate possessing any incriminating material(s) (whether used or not). For example:-Written or printed materials, bits of papers containing written information, writings on scale, calculator, handkerchief, dress, part of the body, Hall Ticket, etc.</td><td rowspan="8">Invalidating the examination of the subject concerned and all the theory and the practical subjects of the current semester registered by the candidate.
Further the candidate is not considered for revaluation of answer scripts of the arrears-subjects.
If the candidate has registered for arrears - subjects only, invalidating the examinations of all the arrears - subjects registered by the candidate.</td></tr>
<tr><td>11.</td><td>The candidate possessing cell phone(s)/ programmable calculator(s)/any other electronic storage device(s) gadgets and containing incriminating materials (whether used or not).</td></tr>
<tr><td>12.</td><td>The Candidate possessing the question paper of another candidate with additional writing on it.</td></tr>
<tr><td>13.</td><td>The candidate passing his/her question paper to another candidate with additional writing on it</td></tr>
<tr><td>14.</td><td>The candidate passing incriminating materials brought into the examination hall in any medium (hard/soft) to other candidate(s).</td></tr>
<tr><td>15.</td><td>The candidate copying from neighbouring candidate.</td></tr>
<tr><td>16.</td><td>The candidate taking out of the examination hall answer booklet(s), used or unused</td></tr>
<tr><td>17.</td><td>Appeal by the candidate in the answer script coupled with a promise of any form of consideration.</td></tr>
<tr><td>18.</td><td>Candidate destroying evidence relating to an alleged irregularity.</td><td>Invalidating the examinations of the subject concerned and all the theory and the practical subjects of the current semester registered by the candidate.
Further the candidate is not considered for revaluation of answer scripts of the arrears-subjects.
If the candidate has registered for arrears - subjects only, invalidating the examinations of all the arrears - subjects registered by the candidate.</td></tr>
</table>

	.	**Additional Punishment :** i. If the candidate has not completed the programme, he/she is debarred from continuing his/her studies for one year i.e., for two subsequent semesters. However the student is permitted to appear for the examination in all the arrears-subjects during the debarred period. ii. If the candidate has completed the programme, he/she is prevented from writing the examinations of the arrears - subjects for two subsequent semesters.
19.	Vulgar/offensive writings by the candidate in the answer script.	Invalidating the examinations of all the theory and practical subjects of the current semester and all the arrears -subjects registered by the candidate.
20.	The candidate possessing the answer script of another candidate	
21.	The candidate passing his /her answer script to another candidate	
22.	Involved in any one or more of the malpractices of serial no. 8 to 21 for the second or subsequent times.	Invalidating the examinations of all the theory and practical subjects of the current semester and all the arrears -subjects registered by the candidate. **Additional Punishment :** i. If the candidate has not completed the programme, he/she is debarred from continuing his/her studies for one year i.e., for two subsequent semesters. However the student is permitted to appear for the examination in all the arrears-subjects during the debarred period. ii. If the candidate has completed the programme, he/she is prevented from writing the examinations of the arrears - subjects for two subsequent semesters.
23.	The candidate substituting an answer book let prepared outside the examination hall for the one already distributed to the candidate	

<table>
<tr><td>24.</td><td>The candidate indulge in any disruptive conduct including, but not limited to, shouting, assault of invigilator, officials or students using abusive and /or threatening language, destruction of property.</td><td rowspan="3">Invalidating the examinations of all the theory and practical subjects of the current semester and all the arrears -subjects registered by the candidate.
Additional Punishment :
i. If the candidate has not completed the programme, he/she is debarred from continuing his/her studies for two years i.e., for four subsequent semesters. However the student is permitted to appear for the examination in all the arrears-subjects during the debarred period.
ii. If the candidate has completed the programme, he/she is prevented from writing the examinations of the arrears-subjects for four subsequent semesters.</td></tr>
<tr><td>25.</td><td>The candidate harass or engage others to harass on his/her behalf an invigilator, official, witnesses or any other person in relation to an irregularity by making telephone calls, visits, mails or by any other means.</td></tr>
<tr><td>26.</td><td>Candidate possessing any firearm/weapon inside the examination hall.</td></tr>
<tr><td>27.</td><td>Cases of Impersonation</td><td>i. Handing over the impersonator to the police with a complaint to take appropriate action against the person involved in the impersonation by the Chief Supt.
If a student of this University is found to impersonate a ‘bonafide student’, the impersonating student is debarred from continuing his/her studies and writing the examinations permanently. He/she is not eligible for any further admission to any programme of the University.
Debarring the ‘bonafide student’ for whom the impersonation was done from continuing his/her studies and writing the examinations permanently. He/she is not eligible for any further admission to any programme of the University.</td></tr>
</table>

APPENDIX - IV

Process to Consider the Application for Revocation of Detainment

The process to consider the application for revocation of detainment on account of lack of attendance in 3 or more courses, due to genuine reasons (viz. sports participation, NCC, Medical Grounds etc.) is as follows:

The student submits an application for consideration via a request letter to the CoE,not later than 3 days from the last working day, along with the HoD's recommendation, Class Advisor's report and Mentor's recommendation. A committee consisting of the Principal, CoE, HoD (Respective Department) and HoD's-2 from departments other than the student's own. The committee shall meet within 4 working days,to consider the case. Stakeholders may be called to be present in the meeting as may be required, and Decision arrived at.The decision approved by Principal shall be final.

APPENDIX - V

Academic Evaluation Committee (AEC)

The committee includes the Principal, CoE, HoD concerned. The committee meets to carry out business related to academic matters which require central decision making and approval viz. retest approval of missed CIA, addressing the feedback collected from the various departments' class committee meetings.

Department Evaluation Committee (DEC)

The committee includes HoD (need basis), and a few faculty members of the department from various levels. The committee meets to carry out business related to academic matters that can be addressed within the department viz. course equivalence of common courses for readmitted students; approval of new courses to be offered by the department; consider and approve the credit equivalence of courses offered by industry, review the course offerings; consider the merit of applications involving lack of attendance in PE/OE courses to take up another PE or OE; approve CIAM only courses every semester; approve scheme of assessment for each course; Approval for and Mapping credits of certification courses; approval of list of nationally or internationally recognized professional certification courses with prometric testing.

Curriculum

Conceptual Frame work

(For Students admitted from the Academic Year 2019–20 and onwards)

Semester	Level of Course	Hrs. / Week	No of Courses	Range of Credits / Courses	Total Credits
PART – I					
A – Foundation Courses					
I to II	Humanities and Social Sciences **(HS)**	1- 3	5	1 - 3	11
I to IV	Basic Sciences **(BS)**	3 - 4	6	2 - 4	25
I to III	Engineering Sciences **(ES)**	3 - 6	8	2 - 4	19
B – Professional Core Courses					
II to VII	Professional Core **(PC)**	3 - 4	30	2 - 4	71
C – Elective Courses					
V to VIII	Professional Elective **(PE)**	3	6	3	18
V to VIII	Open Elective **(OE)**	3	4	3	12
D – Project Work					
V, VII & VIII	Project Work **(PW)**	4 - 16	3	2 - 8	12
E – Mandatory Courses Prescribed by AICTE / UGC (Not to be Included for CGPA)					
I, III & IV	Mandatory Course **(MC)**	3	4	NC	NC
Total Credit					**168**
PART II – Career Enhancement Courses (CEC)					
II	Soft Skills - I	2	1	1	1
III	Soft Skills - II	2	2	1	1
	Professional Certificate Course - I	2		1	1
IV	Career Ability Course - I	2	1	-	-
	NPTEL Online Certificate Courses	-	-	-	-
V	Career Ability Course - II	2	3	-	-
	Professional Certificate Course - II	2		1	1
	Summer Internship	-		1	1
VI	Career Ability Course - III	2	1	-	-
	NPTEL Online Certificate Courses	-	-	-	-
Total Credit					**05**
Total Credit to be Earned					**173**
PART III (Additional Credit Course - Not to be Included for CGPA)					
III	Problem Solving and Python Programming	20 - 30	1	-	**1**
IV	Non Destructive Testing (NDT)	20 - 30	1	-	**1**
V	Basics of Automation	40 - 60	1	-	**1**
VI	CNC Certification Programme	40 - 60	1	-	**1**
VII	Robotics and Embedded Systems	30 - 40	1	-	**1**

BoS Chairman

Scheme of Instructions and Examinations

(For Students admitted from the Academic Year 2019-20 and onwards)

Semester - I

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
Induction Programme											
B19ENT101	Functional English	**HS**	3	3	0	0	**3**	40	60	100	**3**
B19MAT101	Matrices and Differential Calculus	**BS**	4	3	0	1	**3**	40	60	100	**4**
B19PHT101	Engineering Physics	**BS**	3	3	0	0	**3**	40	60	100	**3**
B19CST101	Problem Solving and Python Programming	**ES**	3	3	0	0	**3**	40	60	100	**3**
B19MET101	Engineering Graphics	**ES**	6	2	4	0	**3**	40	60	100	**4**
B19PHP101	Physics Laboratory	**BS**	4	0	4	0	**3**	40	60	100	**2**
B19CSP101	Problem Solving and Python Programming Laboratory	**ES**	4	0	4	0	**3**	40	60	100	**2**
B19MCP101	Life Skills	**MC**	2	0	2	0	**-**	100	-	100	**NC**
Total Contact Hours/Week			**29**	**14**	**14**	**1**	**Total Credits**				**21**

Semester - II

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19ENT201	Professional English	**HS**	3	3	0	0	**3**	40	60	100	**3**
B19MAT201	Integral Calculus and Complex Analysis	**BS**	4	3	0	1	**3**	40	60	100	**4**
B19CHT101	Engineering Chemistry	**BS**	3	3	0	0	**3**	40	60	100	**3**
B19MET207	Fundamentals of Civil and Mechanical Engineering	**ES**	3	3	0	0	**3**	40	60	100	**3**
B19EET201	Basic Electrical Engineering	**ES**	4	3	0	1	**3**	40	60	100	**4**
B19HST201	தமிழர்மரபு / Heritage of Tamils	**HS**	1	1	0	0	**3**	40	60	100	**1**
B19CHP101	Chemistry Laboratory	**BS**	4	0	4	0	**3**	40	60	100	**2**
B19EEP201	Circuits and Simulation Laboratory	**ES**	2	0	2	0	**3**	40	60	100	**1**
B19MEP201	Basic Workshop Practices Laboratory	**ES**	4	0	4	0	**3**	40	60	100	**2**
B19CEP201	Soft Skills - I	**CEC**	2	0	2	0	**-**	100	-	100	**1**
Total Contact Hours/Week			**29**	**15**	**12**	**2**	**Total Credits**				**24**

BoS Chairman

Semester - III												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19MAT303	Transforms and Partial Differential equations	**BS**	4	3	0	1	**3**	40	60	100	**4**
B19EET301	Field Theory	**PC**	4	3	0	1	**3**	40	60	100	**4**
B19EET302	Electronic Devices and Integrated Circuits	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19EET303	Measurements and Instrumentation	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19EET304	DC Machines and Transformers	**PC**	4	3	0	1	**3**	40	60	100	**4**
B19MCT301	Environmental Sciences	**MC**	3	3	0	0	**-**	100	-	100	**NC**
B19HST301	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	**HS**	1	1	0	0	**3**	40	60	100	**1**
B19EEP301	DC Machines and Transformers Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19EEP302	Measurements and Instrumentation Laboratory	**PC**	2	0	2	0	**3**	40	60	100	**1**
B19CEP301	Soft Skills -II	**CEC**	2	0	2	0	-	100	-	100	**1**
B19CEP302	Professional Certificate Course-I	**CEC**	2	0	2	0	-	100	-	100	**1**
Total Contact Hours/Week			31	**18**	**10**	**3**	**Total Credits**				**24**

In plant training - Review will be conducted in 1st week of Semester IV and it will be included in the Semester IV mark statement

Semester - IV												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19MAT402	Numerical Methods	**BS**	4	3	0	1	**3**	40	60	100	**4**
B19EET401	Control Engineering	**PC**	4	3	0	1	**3**	40	60	100	**4**
B19EET402	Induction and Synchronous Machines	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19EET403	Generation Transmission and Distribution	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19EET404	Digital Logic Circuits	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19MCT302	Indian Constitution	**MC**	3	3	0	0	**-**	100	-	100	**NC**
B19EEP401	AC Machines and Control system Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19EEP402	Linear and Digital Integrated Circuits Laboratory	**PC**	2	0	2	0	**3**	40	60	100	**1**
B19CEP401	Career Ability Course - I	**CEC**	2	0	2	0	-	100	-	100	**NC**
B19CEP402	In-plant Training	**CEC**	-	-	-	-	-	-	-	-	**NC**
B19CEP403	Online Certificate Course - I		-	-	-	-	-	-	-	-	**NC**
Total Contact Hours/Week			**28**	**18**	**8**	**2**	**Total Credits**				**20**

Summer Internship - Duration 15 days (Review will be conducted in 1st week of Semester V and credit will be included in the Semester V mark statement)
Online Certificate Courses (like NPTEL,SWAYAM,Coursera,etc…) has to be completed within second year (NC)

BoS Chairman

Semester - V												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EET501	Design of Electrical Machines	PC	4	3	0	1	3	40	60	100	4
B19EET502	Power Electronics	PC	3	3	0	0	3	40	60	100	3
B19EET503	Introduction to Microprocessor and Microcontrollers	PC	3	3	0	0	3	40	60	100	3
B19CST511	Data Structures and Algorithms	PC	3	3	0	0	3	40	60	100	3
	Professional Elective - I	PE	3	3	0	0	3	40	60	100	3
	Open Elective- I	OE	3	3	0	0	3	40	60	100	3
B19EEP501	Microprocessor and Microcontrollers Laboratory	PC	4	0	4	0	3	40	60	100	2
B19EEP502	Power Electronics Laboratory	PC	4	0	4	0	3	40	60	100	2
B19CEP501	Career Ability Course - II	CEC	2	0	2	0	-	100	-	100	NC
B19CEP502	Professional Certificate Course-II	CEC	2	0	2	0	-	100	-	100	1
B19CEP503	Summer Internship	CEC	-	-	-	-	-	-	-	-	1
Total Contact Hours / Week			**31**	**18**	**12**	**1**	**Total Credits**				**25**

Semester - VI												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EET601	Electrical Drives and Control	PC	3	3	0	0	3	40	60	100	3
B19EET602	Power System - I	PC	3	3	0	0	3	40	60	100	3
B19EET603	Embedded and Real Time Systems	PC	3	3	0	0	3	40	60	100	3
	Professional Elective - II	PE	3	3	0	0	3	40	60	100	3
	Professional Elective - III	PE	3	3	0	0	3	40	60	100	3
	Open Elective - II	OE	3	3	0	0	3	40	60	100	3
B19EEP601	Electrical Drives and control Laboratory	PC	4	0	4	0	3	40	60	100	2
B19EEP602	Mini Project	PW	4	0	4	0	-	100	-	100	2
B19CEP601	Career Ability Course - III	CEC	2	0	2	0	-	100	-	100	NC
B19CEP602	Online Certificate Course - II	CEC	-	-	-	-	-	-	-	-	NC
Total Contact Hours / Week			**28**	**18**	**10**	**0**	**Total Credits**				**22**
Online Certificate Courses (like NPTEL, SWAYAM, Coursera, etc..) has to be completed within third year (NC)												

BoS Chairman

Semester - VII

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EET701	Power System- II	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19EET702	Protection and Switchgear	**PC**	3	3	0	0	**3**	40	60	100	**3**
	Professional Elective-IV	**PE**	3	3	0	0	**3**	40	60	100	**3**
	Professional Elective-V	**PE**	3	3	0	0	**3**	40	60	100	**3**
	Open Elective - III	**OE**	3	3	0	0	**3**	40	60	100	**3**
B19EEP701	Power System and Renewable Systems Laboratory	PC	2	0	2	0	3	40	60	100	**1**
B19EEP702	Comprehension and Technical Seminar	ES	2	0	2	0	-	100	-	100	**1**
B19EEP703	Project Work Phase - I	PW	4	0	4	0	**3**	40	60	100	**2**
Total Contact Hours/Week			**23**	**15**	**8**	**0**	**Total Credits**				**19**

Semester - VIII

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
	Professional Elective - VI	**PE**	3	3	0	0	**3**	40	60	100	**3**
	Open Elective-IV	**OE**	3	3	0	0	**3**	40	60	100	**3**
B19EEP801	Project Work Phase - II	**PW**	16	0	16	0	**3**	40	60	100	**8**
Total Contact Hours/Week			**22**	**6**	**16**	**0**	**Total Credits**				**14**

HUMANITIES AND SOCIALSCIENCES (HS)

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19ENT101	Functional English	**HS**	3	3	0	0	**3**	40	60	100	**3**
B19ENT201	Professional English	**HS**	3	3	0	0	**3**	40	60	100	**3**
B19HST201	தமிழர்மரபு / Heritage of Tamils	**HS**	1	1	0	0	**3**	40	60	100	1
B19HST301	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	**HS**	1	1	0	0	**3**	40	60	100	1

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BASIC SCIENCES (BS)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19MAT101	Matrix Algebra and Differential Calculus	BS	4	3	0	1	3	40	60	100	4
B19PHT101	Engineering Physics	BS	3	3	0	0	3	40	60	100	3
B19PHP101	Physics Laboratory	BS	4	0	4	0	3	40	60	100	2
B19MAT201	Integral Calculus and Complex Analysis	BS	4	3	0	1	3	40	60	100	4
B19CHT101	Engineering Chemistry	BS	3	3	0	0	3	40	60	100	3
B19CHP101	Chemistry Laboratory	BS	4	0	4	0	3	40	60	100	2
B19MAT303	Transforms and Partial Differential equations	BS	4	3	0	1	3	40	60	100	4
B19MAT402	Numerical Methods	BS	4	3	0	1	3	40	60	100	4

ENGINEERING SCIENCES (ES)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19CST101	Problem Solving and Python Programming	ES	3	3	0	0	3	40	60	100	3
B19MET101	Engineering Graphics	ES	4	2	4	0	3	40	60	100	3
B19CSP101	Problem Solving and Python Programming Laboratory	ES	4	0	4	0	3	40	60	100	2
B19MET207	Fundamentals of Civil and Mechanical Engineering	ES	3	3	0	0	3	40	60	100	3
B19EET201	Basic Electrical Engineering	ES	4	3	0	1	3	40	60	100	4
B19EEP201	Circuits and Simulation Laboratory	ES	2	0	2	0	3	40	60	100	1
B19MEP201	Basic Workshop Practices Laboratory	ES	4	0	4	0	3	40	60	100	2
B19EEP702	Comprehension and Technical presentation	ES	2	0	2	0	-	40	-	100	1

BoS Chairman

PROFESSIONAL CORE (PC)												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EET301	Field Theory	PC	4	3	0	1	3	40	60	100	4
B19EET302	Electronic Devices and Integrated Circuits	PC	3	3	0	0	3	40	60	100	3
B19EET303	Measurements and Instrumentation	PC	3	3	0	0	3	40	60	100	3
B19EET304	DC Machines and Transformers	PC	4	3	0	1	3	40	60	100	4
B19EEP301	DC Machines and Transformers Laboratory	PC	4	0	4	0	3	40	60	100	2
B19EEP302	Measurements and Instrumentation Laboratory	PC	2	0	2	0	3	40	60	100	1
B19EET401	Control Engineering	PC	4	3	0	1	3	40	60	100	4
B19EET402	Induction and Synchronous Machines	PC	3	3	0	0	3	40	60	100	3
B19EET403	Generation Transmission and Distribution	PC	3	3	0	0	3	40	60	100	3
B19EET404	Digital Logic Circuits	PC	3	3	0	0	3	40	60	100	3
B19EEP401	AC Machines and Control system Laboratory	PC	4	0	4	0	3	40	60	100	2
B19EEP402	Linear and Digital Integrated Circuits Laboratory	PC	2	0	2	0	3	40	60	100	1
B19EET501	Design of Electrical Machines	PC	4	3	0	1	3	40	60	100	4
B19EET502	Power Electronics	PC	3	3	0	0	3	40	60	100	3
B19EET503	Introduction to Microprocessor and Microcontrollers	PC	3	3	0	0	3	40	60	100	3
B19CST511	Data Structures and Algorithms	PC	3	3	0	0	3	40	60	100	3
B19EEP501	Microprocessor and Microcontroller Laboratory	PC	4	0	4	0	3	40	60	100	2
B19EEP502	Power Electronics Laboratory	PC	2	0	2	0	3	40	60	100	2
B19EET601	Electrical Drives and Control	PC	3	3	0	0	3	40	60	100	3
B19EET602	Power System- I	PC	3	3	0	0	3	40	60	100	3
B19EET603	Embedded and Real Time Systems	PC	3	3	0	0	3	40	60	100	3
B19EEP601	Electrical Drives and Control Laboratory	PC	2	0	2	0	3	40	60	100	2
B19EET701	Power System - II	PC	3	3	0	0	3	40	60	100	3
B19EET702	Protection and switchgear	PC	3	3	0	0	3	40	60	100	3
B19EEP701	Power System and Renewable Systems Laboratory	PC	2	0	2	0	3	40	60	100	1

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PROFESSIONAL ELECTIVES (PE)

SEMESTER - V

ELECTIVE - I

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EEE501	PLC and SCADA	PE	3	3	0	0	3	40	60	100	3
B19EEE502	Communication Engineering	PE	3	3	0	0	3	40	60	100	3
B19EEE503	Digital Signal Processing	PE	3	3	0	0	3	40	60	100	3
B19EEE504	IoT for Electrical Engineering	PE	3	3	0	0	3	40	60	100	3
B19EEE505	Special Electrical Machines	PE	3	3	0	0	3	40	60	100	3

SEMESTER - VI

ELECTIVE - II

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EEE601	Energy Management and Auditing	PE	3	3	0	0	3	40	60	100	3
B19EEE602	High Voltage Engineering	PE	3	3	0	0	3	40	60	100	3
B19EEE603	Digital Control System	PE	3	3	0	0	3	40	60	100	3
B19EEE604	IPR and Human Rights	PE	3	3	0	0	3	40	60	100	3
B19CST201	Programming in C	PE	3	3	0	0	3	40	60	100	3

SEMESTER - VI

ELECTIVE - III

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EEE605	Solar Energy Technology	PE	3	3	0	0	3	40	60	100	3
B19EEE606	Power System Transients	PE	3	3	0	0	3	40	60	100	3
B19EEE607	Electromagnetic field Computation and Modelling	PE	3	3	0	0	3	40	60	100	3
B19EEE608	Industrial Safety and Environment	PE	3	3	0	0	3	40	60	100	3
B19EEE609	Introduction to Artificial Intelligence	PE	3	3	0	0	3	40	60	100	3

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SEMESTER - VII											
ELECTIVE - IV											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EEE701	Power Electronics Application for Renewable Energy Systems	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE702	FACTS and HVDC	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19BMT501	Biomedical Instrumentation	**PE**	3	0	3	0	**3**	40	60	100	**3**
B19EEE703	Principles of Management and Professional Ethics	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE704	Machine Learning for Electrical Engineering	**PE**	3	3	0	0	**3**	40	60	100	**3**

SEMESTER - VII											
ELECTIVE - V											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EEE705	Electric Vehicle	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE706	Industrial Power System Analysis	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE707	Micro Controller Based System Design	**PE**	3	0	3	0	**3**	40	60	100	**3**
B19EEE708	Deregulation of Electrical Energy System	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE709	Optimization Techniques	**PE**	3	3	0	0	**3**	40	60	100	**3**

SEMESTER - VIII											
ELECTIVE - VI											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EEE801	Utilization and Conservation of Electrical Energy	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE802	Industrial Communication	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE803	FPGA Based System Design	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE804	Total Quality Management	**PE**	3	3	0	0	**3**	40	60	100	**3**
B19EEE805	Smart Grid	**PE**	3	3	0	0	**3**	40	60	100	**3**

BoS Chairman

PROJECT WORK (PW)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19EEP602	Mini Project	PW	4	0	4	0	-	100	-	100	2
B19EEP703	Project Phase - I	PW	4	0	4	0	3	40	60	100	2
B19EEP801	Project Phase - II	PW	16	0	16	0	3	40	60	100	8

MANDATORY COURSE (MC)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19MCP101	Life Skills	MC	2	0	2	0	-	100	-	100	NC
B19MCT301	Environmental Sciences	MC	3	3	0	0	-	100	-	100	NC
B19MCT302	Indian Constitution	MC	3	3	0	0	-	100	-	100	NC

CAREER ENHANCEMENT COURSE (CEC)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19CEP201	Soft Skills -I	CEC	2	0	2	0	-	100	-	100	1
B19CEP301	Soft Skills - II	CEC	2	0	2	0	-	100	-	100	1
B19CEP302	Professional Certificate Course-I	CEC	2	0	2	0	-	100	-	100	1
B19CEP401	Career Ability Course - I	CEC	2	0	2	0	-	100	-	100	NC
B19CEP402	In Plant Training	CEC	-	-	-	-	-	-	-	-	NC
B19CEP403	Online Certificate Course - I	CEC	-	-	-	-	-	-	-	-	NC
B19CEP501	Career Ability Course - II	CEC	2	0	2	0	-	100	-	100	NC
B19CEP502	Professional Certificate Course-II	CEC	2	0	2	0	-	100	-	100	1
B19CEP503	Summer Internship	CEC	-	-	-	-	-	-	-	-	1
B19CEP601	Career Ability Course -III	CEC	2	0	2	0	-	100	-	100	NC
B19CEP602	Online Certificate Course - II	CEC	-	-	-	-	-	-	-	-	NC

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OPEN ELECTIVES (OE)												
SEMESTER - V												
ELECTIVE - I												
Course Code	**Course Name**	**Category**	**Instructional Hours**				**Assessment**					**Credit**
			Contact Periods	**T**	**P**	**TU**	**Hours of Exam. (ESE)**	**CIA**	**ESE**	**Total**		
B19AEO501	Basics of Flight Mechanics	**OE**	3	3	0	0	**3**	40	60	100		**3**
B19AGO501	Environment and Agriculture	**OE**	3	3	0	0	**3**	40	60	100		**3**
B19BMO501	Introduction to Medical Physics	**OE**	3	0	3	0	**3**	40	60	100		**3**
B19BTO501	Food Processing and Preservation	**OE**	3	3	0	0	**3**	40	60	100		**3**
B19CSO501	Fundamentals of Database Management System	**OE**	3	0	3	0	**3**	40	60	100		**3**
B19ECO501	Logic and Distributed Control System	**OE**	3	3	0	0	**3**	40	60	100		**3**
B19MEO501	Robotics	**OE**	3	0	3	0	**3**	40	60	100		**3**

SEMESTER - VI												
ELECTIVE - II												
Course Code	**Course Name**	**Category**	**Instructional Hours**				**Assessment**					**Credit**
			Contact Periods	**T**	**P**	**TU**	**Hours of Exam. (ESE)**	**CIA**	**ESE**	**Total**		
B19AEO601	Aircraft Electrical and Electronic Systems	**OE**	3	3	0	0	**3**	40	60	100		**3**
B19AGO601	Integrated Water Resources Management	**OE**	3	3	0	0	**3**	40	60	100		**3**
B19BMO601	Introduction to Biomedical Engineering	**OE**	3	0	3	0	**3**	40	60	100		**3**
B19BTO601	Basic Bioinformatics	**OE**	3	3	0	0	**3**	40	60	100		**3**
B19CSO601	E- Commerce Technology and Management	**OE**	3	0	3	0	**3**	40	60	100		**3**
B19ECO601	Geographic Information System	**OE**	3	3	0	0	**3**	40	60	100		**3**
B19MEO601	Entrepreneurship Development	**OE**	3	0	3	0	**3**	40	60	100		**3**

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SEMESTER - VII												
ELECTIVE - III												
Course Code	Course Name	Category	Instructional Hours				Assessment					Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total		
B19AEO701	Unmanned Aircraft Systems operation and MRO	OE	3	3	0	0	3	40	60	100		3
B19AGO701	Production Technology for Agriculture Machinery	OE	3	3	0	0	3	40	60	100		3
B19BMO701	Telemedicine	OE	3	0	3	0	3	40	60	100		3
B19BTO701	Fundamentals of Nanotechnology	OE	3	0	3	0	3	40	60	100		3
B19CSO701	Fundamentals of Cloud Computing	OE	3	3	0	0	3	40	60	100		3
B19ECO701	Introduction to Communication Systems	OE	3	3	0	0	3	40	60	100		3
B19MEO701	3D Printing and Tooling	OE	3	3	0	0	3	40	60	100		3

SEMESTER - VIII											
ELECTIVE - IV											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AEO801	Vehicle Aerodynamics	OE	3	3	0	0	3	40	60	100	3
B19AGO801	Agriculture Finance Banking and Cooperatives	OE	3	3	0	0	3	40	60	100	3
B19BMO801	Hospital Management	OE	3	0	3	0	3	40	60	100	3
B19BTO801	Biological Waste Management	OE	3	0	3	0	3	40	60	100	3
B19CSO801	Fundamentals of IoT	OE	3	3	0	0	3	40	60	100	3
B19ECO801	Wireless Technologies	OE	3	3	0	0	3	40	60	100	3
B19MEO801	Lean Six Sigma	OE	3	3	0	0	3	40	60	100	3

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Semester - I

B.E / B.Tech	B19ENT101 - FUNCTIONAL ENGLISH (Common to all Branches)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To develop the basic reading and writing skills of first year engineering and technology students.
2.	To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
3.	To help learners develop their speaking skills and speak fluently in real contexts.
4.	To help learners develop vocabulary of a general kind by developing their reading skills.
5.	To enhance their basic grammatical knowledge and Vocabulary skills.

UNIT - I	12
Reading	Short comprehension passages, practice in skimming-scanning
Writing	Instructions, developing hints.
Listening	Listening to peer group
Speaking	Self Introduction, introducing others
Language development	Parts of Speech, Wh-Questions, asking and answering-yes or no questions
Vocabularydevelopment	Prefixes-suffixes, articles.

UNIT - II	12
Reading	Skimming and Scanning - Pre & post reading, comprehension questions, including dialogues and conversations
Writing	Paragraph writing, free writing, day to day events
Listening	Telephonic conversations, conceptual conversations
Speaking	Sharing information of a personal kind, greeting, taking leave
Language development	Regular & Irregular Verbs, tenses
Vocabularydevelopment	Guessing meanings of words in context.

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UNIT - III	12
Reading	Short texts and longer passages, note making
Writing	Understanding text structure, use of reference words and discourse markers, jumbled sentences
Listening	Listening to longer texts and filling up the table, product description, narratives from different sources.
Speaking	Short presentation, asking about routine actions and expressing facts and opinions
Language development	Idioms and Phrases, Degrees of comparison, sentence pattern and types of sentences
Vocabularydevelopment	single word substitutes

UNIT - IV	12
Reading	Intensive and Extensive reading, reading longer texts, reading different types of texts-magazines,
Writing	letter writing, informal or personal letters, e-mails
Listening	listening to dialogues or conversations and completing exercises based on them
Speaking	speaking about oneself, speaking about one's friend, conceptual conversations
Language development	direct/indirect questions
Vocabularydevelopment	synonyms-antonyms, phrasal verbs

UNIT - V	12
Reading	longer texts-close reading
Writing	writing short essays, developing an outline, identifying main and subordinate ideas, dialogue Writing
Listening	listening to talks, conversations
Speaking	participating in conversations, short group conversations

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Language development	Spelling and Punctuations, modal verbs
Vocabularydevelopment	collocations
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Develop basic reading and effective reading skills.
CO2	Build their grammatical understanding.
CO3	Explain their opinions efficiently in writing in formal and informal contexts through letters.
CO4	Develop their vocabulary skills.
CO5	Develop their knowledge through LSRW skills.

Text Books	
1.	Board of Editors Using English, "A Course book for Undergraduate Engineers and Technologists", Orient Black Swan Limited, Hyderabad: 2015
2.	Richards, C. Jack, "Interchange Students Book-2", New Delhi, CUP, 2015.

Reference Books	
1.	Bailey, Stephen, "A practical guide for students", New York Rutledge, 2011.
2.	Comfort, Jeremy,et al, "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge, Reprint 2011.
3.	Dutt P. Kiranmai and Rajeevan Geeta, "Basic Communication Skills", Foundation Books, 2013.

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B.E / B.Tech	B19MAT101 - MATRICES AND DIFFERENTIAL CALCULUS (Common to all Branches)	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	Matrix algebra is one of the powerful tools to handle practical problems arising in the field of engineering.
2.	The goal of this course is to achieve conceptual understanding and to retain the best traditions of differential calculus.
3.	This is a foundation course which mainly deals with topics such as single variable and multivariable differential calculus and plays an important role in the understanding of science, engineering, medical and business among other disciplines.
4.	To provide the basic tools of differential calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
5.	To make the student appreciate the purpose of using Laplace transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT - I	MATRICES	12
Eigen values and Eigenvectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigenvectors - Cayley - Hamilton theorem - Quadratic form: Nature, Reduction to canonical form by orthogonal transformation.		

UNIT - II	FUNCTIONS OF SEVERAL VARIABLES	12
Partial differentiation -Total derivative - Change of variables - Jacobians - Taylor‘s series expansion for functions of two variables - Maxima and minima of functions of two variables - Lagrange‘s method of undetermined multipliers.		

UNIT - III	ORDINARY DIFFERENTIAL EQUATIONS	12
Higher order linear ordinary differential equations with constant coefficients - Higher order linear ordinary differential equations with variable coefficients Cauchy Euler‘s and Cauchy Legendre‘s type - Method of variation of parameters (ordinary differential equations with constant coefficients) - Simultaneous differential equations.		

UNIT - IV	APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS	12
Solution of specified differential equations connected with electric circuits, Bending of beams and simple harmonic motion (Differential equations and associated conditions need to be given).		

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UNIT - V	LAPLACE TRANSFORMS	12
Existence conditions - Properties (excluding proofs) - Transform of standard functions - Transforms of derivatives and integrals - Periodic function - Inverse Laplace transform - Applications to solution of linear second order ordinary differential equations with constant coefficients.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Make use of Eigen values and Eigen vectors to reduce the quadratic form into canonical form and to find the powers of a square matrix.
CO2	Identify the solution for maxima and minima problems.
CO3	Solve differential equations which existing in different engineering disciplines.
CO4	Develop the applications of differential equations in various engineering field.
CO5	Apply Laplace transform and inverse transform to solve differential equations with constant coefficients.

Text Books	
1.	Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media -An imprint of Lakshmi Publications Pvt., Ltd., New Delhi, 7th Edition, 2017.
3.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

Reference Books	
1.	Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2018.
2.	Srimantha Pal and Bhunia, S.C, "Engineering Mathematics", Oxford University Press, 2015.
3.	Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.
4.	Veerarajan T., “Engineering Mathematics for Semester I and II”, Tata McGraw Hill Publishing Company, New Delhi,2015.
5.	Gean Duffy., “Advanced Engineering Mathematics with MATLAB”, A CRC Press Company, Boca Raton London , New York Washington, D.C, 2nd edition 2009.

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B.E / B.Tech	B19PHT101 - ENGINEERING PHYSICS (Common to all Branches)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To gain knowledge on the basics of properties of matter and its applications.
2.	To acquire knowledge on the concepts of Photonics and their applications in fiber optics.
3.	To have adequate knowledge on the concepts of Ultrasonics and their applications.
4.	To get knowledge on advanced physics concepts of quantum theory and its applications in SEM, TEM.
5.	To make the students enhance the fundamental knowledge in Crystal Physics and its applications relevant to various streams of Engineering and Technology.

UNIT - I	PROPERTIES OF MATTER	9

Elasticity-Modulus, types of modulus, Stress-strain diagram and its uses-factors affecting elastic modulus and tensile strength-Twisting couple, torsion pendulum; theory and experiment.
Bending of beams- Bending moment- cantilever; theory and experiment- uniform and non-uniform bending; theory and experiment- I-shaped girders.

UNIT - II	PHOTONICS AND FIBER OPTICS	9

Lasers; Population of energy levels, Einstein‘s A and B coefficients derivation- resonant cavity, optical amplification (qualitative) - Types; Nd-YAG Laser, Semiconductor lasers; homojunction and heterojunction, Industrial and Medical Applications.
Fibre Optics; Principle, Numerical Aperture and Acceptance Angle - Types of optical fibres (material, refractive index, mode) - Applications; Fibre optic communication system-Block diagram, fibre optic sensors- pressure and displacement sensors -Endoscopy.

UNIT - III	ULTRASONICS	9

Classification of Sound, Production of ultrasonics - Magnetostriction generators, piezoelectric generators - acoustic grating - cavitation - ultrasonic cleaning.
Applications; Non Destructive Testing, pulse echo system through transmission and reflection modes, A, B and C, scan displays- Engineering applications; SONAR,- Medical applications; Sonograms.

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UNIT - IV	QUANTUM PHYSICS	9
Black body radiation; Planck's theory (derivation) - wave particle duality - debroglie wavelength - electron diffraction - Davisson-Germer experiment - concept of wave function and its physical significance. Wave equation; Schroedinger's time independent and time dependent equations, particle in a one - dimensional rigid box - Applications; Scanning Electron Microscope(SEM) and Transmission Electron Microscope (TEM).		

UNIT - V	CRYSTAL PHYSICS	9
Crystal Structures; Single crystalline, polycrystalline and amorphous materials - unit cell - crystal systems - Bravais lattices - Miller indices - inter-planar distances - coordination number and packing factor for SC, BCC, FCC and HCP structures - Crystal imperfections; Point and Line defects. Growth of single crystals; Solution and melt growth techniques (Bridgeman &Czhochralski)		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the basics of Properties of matter and its applications.
CO2	Illustrate the basics of Laser, Fiber optics and their applications.
CO3	Infer the concepts of ultrasonics and its applications.
CO4	Interpret the basic knowledge of Quantum theory that could be helpful in understanding the wave functions of a particle.
CO5	Classify and compare the different types of crystals, their structures and its preparation techniques.

Text Books	
1.	Bhattacharya, D.K. &Poonam, T, "Engineering Physics", Oxford University Press, 2015.
2.	Gaur, R.K. & Gupta, S.L. "Engineering Physics", DhanpatRai Publishers, 2012.
3.	Pandey, B.K. &Chaturvedi, S. "Engineering Physics", Cengage Learning India, 2012.
4.	Rajendran V, 'Engineering Physics", Tata McGraw Hill, Publishing Company, New Delhi, 2011.

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Reference Books	
1.	Halliday, D., Resnick, R. & Walker, J. “Principles of Physics’’, Wiley, 2015.
2.	Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”, Cengage Learning, 2010.
3.	Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
4.	Avadhanulu M.N, “Engineering Physics”, Volume 1”, S.Chand & Company Ltd., New Delhi, 2010.

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B.E.	B19CST101- PROBLEM SOLVING AND PYTHON PROGRAMMING (Common to CSE, ECE, EEE & BME)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the basics of problem-solving techniques.
2.	To construct simple python programs.
3.	To develop python programs with conditional statements and loops.
4.	To use python data structures such as lists, tuples, and dictionaries.
5.	To define python functions and use them.

UNIT - I	INTRODUCTION	9

Introduction : Fundamentals of digital computers.

Problem Solving Techniques : Algorithm, Flow Chart, Pseudo code, Program Control Structures, Programming Paradigms.

Programming languages : Generations of Programming Languages, Language Translators, and Features of a Good Programming Languages.

UNIT - II	PYTHON PROGRAMMING BASICS	9

Introduction to Python : Python Interpreter and its working, Syntax and Semantics, Data Types, Assignments and Expressions, operators, comments, Modules and functions.

UNIT - III	CONDITIONAL STATEMENTS AND STRING MANIPULATION	9

Conditional Statements : if, if-else, nested if.

Looping : For, while, nested loop.

Control Statements : break, continue and pass.

String Manipulation : Accessing strings, basic operations, string slices, function and methods.

UNIT - IV	LISTS & TUPLES	9

Lists : Introduction, Accessing list, Operations, Working with lists, Function and Methods.

Tuple : Introduction, Accessing tuples, Operations, Working, Functions and Methods.

Dictionaries : Introduction, Accessing values in dictionaries, working with dictionaries, Properties and Functions.

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UNIT - V	FUNCTIONS & MODULES	9
Functions : Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables. **Modules :** Importing module, Math module, Random module, file handling.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Outline the basics of algorithmic problem solving.
CO2	Make use of basic elements of Python programming to develop applications.
CO3	Make use of various control statements in Python.
CO4	Summarize the build-in data structures of Python.
CO5	Develop Python programs to implement function concepts and modules.

Text Books	
1.	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd Edition, Updated for Python 3, Shroff/ O ‘Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/).
2.	Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python”, Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Books	
1.	ReemaThereja, “Python Programming using Problem Solving Approach”, 4th Impression,Oxford University Press, 2018.
2.	John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press, 2013.
3.	Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd, 2016.
4.	Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd, 2015.
5.	Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.

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B.E / B.Tech	B19MET101 - ENGINEERING GRAPHICS (Common to All)	T	P	TU	C
		2	4	0	4

Course Objectives	
1.	Understand the basic principles of engineering drawing and construction of curves used in engineering field.
2.	To explain about standard principles of orthographic projection of points, lines and planes.
3.	Enable the students to be familiar with various positions of simple solids and disseminate them into different orthographic views.
4.	Create intricate details of components through sections and develop its surfaces.
5.	To improve visualization skills in developing pictorial and perspective views.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)	2
Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning.	

UNIT - I	PLANE CURVES AND FREE HANDSKETCHING	14
Basic Geometrical constructions, Curves used in engineering practices-Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles -Representation of Three-Dimensional objects - Layout of views- Free hand sketching of multiple views from pictorial views of objects.		

UNIT - II	PROJECTION OF POINTS, LINES AND PLANE SURFACE	14
Orthographic projection - principles-Principal planes - First angle projection - Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		

UNIT - III	PROJECTION OF SOLIDS	14
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.		

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UNIT - IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	14
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones.		

UNIT - V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	14
Principles of isometric projection - isometric scale -Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-prisms, pyramids and cylinders by visual ray method.		

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)	3
Introduction to drafting packages and demonstration of their use.	
Total Instructional hours : 75	

Course Outcomes : Students will be able to	
CO1	Develop the basic engineering curves and freehand sketching of basic geometrical constructions and multiple views of objects.
CO2	Construct the projections of points, straight lines and planes.
CO3	Construct the various projection of simple solids.
CO4	Identify the intricate details of components through sections and develop its surface.
CO5	Develop visualization skills in isometric and perspective views.

Text Books	
1.	N.D. Bhattand V.M. Panchal, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.
2.	K. Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International Publishers, 2017.

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Reference Books	
1.	K.R. Gopalakrishna, “Engineering Drawing” (Vol. I & II combined) Subhas Publications, Bangalore, 2018.
2.	K.V. Natarajan, “A text book of Engineering Graphics”, 28^{th} Edition, Dhana Lakshmi Publishers, Chennai, 2015.
3.	N.S Parthasarathy and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015.

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B.E / B.Tech	B19PHP101 - PHYSICS LABORATORY (Common to all Branches)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To introduce different experiments to test basic understanding of physics concepts applied in properties of matter, optics, thermal physics, and liquids.

List of Experiments

Expt. No.	Description of the Experiments	
1.	Determination of rigidity modulus - Torsion pendulum	
2.	Determination of Young's modulus by non-uniform bending method	
3.	Determination of Young's modulus by uniform bending method	
4.	Determination of wavelength of mercury spectrum - spectrometer grating	
5.	Determination of Refractive index of a prism - spectrometer	
6.	Determination of thickness of a thin wire - Air wedge method	
7.	a.	Determination of wavelength, and particle size using Laser
	b.	Determination of acceptance angle in an optical fiber.
8.	Determination of thermal conductivity of a bad conductor - Lee's Disc method	
9.	Determination of band gap of a semiconductor	
10.	Determination of specific resistance of the wire using Carey Foster's Bridge	
11.	Experiment with Poiseuille's apparatus to determine the viscosity of liquids	
12.	Determination of velocity of sound and compressibility of liquid - Ultrasonic Interferometer	
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Classify the elastic properties of the materials by using uniform, non- uniform Bending method and torsional pendulum apparatus.
CO2	Illustrate the Optical properties of light with the help of LASER, Spectrometer and to determine the thickness of the wire using air wedge.

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CO3	Identify the thermal conductivity of bad conductor using Lee's Disc apparatus.
CO4	Utilize the band gap apparatus to find the band gap a semiconductor and determine the specific resistance of the wire using Carey Foster's Bridge.
CO5	Make use of Poiseuilles's apparatus to determine the viscosity of liquid and to determine the velocity of sound and compressibility of liquid by using ultrasonic Interferometer.

List of Equipment Required : Requirements for a Batch of 30 Students

Sl. No.	Description of the Equipment	Quantity required
1.	Torsional Pendulum (with accessories)	6
2.	Non Uniform bending (with Travelling Microscope, Knife edge, Slotted weights and accessories)	6
3.	Uniform Pending (with Travelling Microscope, Knife edge, Slotted weights and accessories)	6
4.	Spectrometer (with Grating and accessories)	6
5.	Spectrometer (with Prism and accessories)	6
6.	Air Wedge Apparatus (with Travelling Microscope and accessories)	6
7.	Diode Laser (2mS power) or He-Ne Laser source (2mW) (Lycopodium Powder, Optical Fibre Kit & accessories)	6
8.	Lee's Disc Apparatus (with accessories)	6
9.	Band Gap Apparatus	6
10.	Carey Foster Bridge (with accessories)	6
11.	Viscosity (Poiseuille's flow) apparatus (with accessories)	6
12.	Ultrosonic Interferometer (with accessories)	6

	Reference Books
1.	Prepared by Physics department.
2.	Senthil Kumar, G. Physics Laboratory I & II, VRB publishers Pvt. Ltd., Chennai (2016).

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B.E.	B19CSP101 - PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY (Common to BME, CSE, ECE & EEE)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To identify and execute the basic programs in Python.
2.	To create the Python programs by using built-in data types and their methods.
3.	To create the user-defined functions and modules in Python.
4.	To implement the file handling operations.
5.	To learn the list and dictionary concepts in Python.

List of Experiments

Expt. No.	Description of the Experiments	
1.	Compute the GCD of two numbers. Find the square root of a number (Newton 's method)	
2.	Basic Python programs for reading input from console.	
	a.	Calculate area of a circle by prompting the user to enter radius value.
	b.	Compute average of three numbers using simultaneous assignment.
3.	Programs using Decision statements.	
	a.	Find the maximum of a list of numbers
	b.	Exponentiation (power of a number)
4.	Programs using Looping and Loop Control statements.	
	a.	Print a list in reverse order (from last to first item) using while and for loops
	b.	Generate Fibonacci series for a given number.
5.	Programs for math operations and random number generation.	
	a.	Compute area of a triangle, given three sides using math module.
	b.	Generate 50 random numbers from a given range of values, using random module.

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6.	Basic programs using the following Python built-in data types and their methods-String, List, Tuple, Set and Dictionary.	
	a.	Count the number of characters in a given word.
	b.	Remove duplicate words from a given string.
	c.	Count the occurrences of the substring in a given string
7.	a.	Implement linear search and binary search using list.
	b.	Matrix operations using Nested List.
8.	Programs using user-defined functions with different types of function arguments.	
	a.	Check whether a given number is Prime or not using function.
	b.	Create a simple calculator that can add, subtract, multiply and divide using functions.
9.	Python programs using Time and Calendar related functions.	
	a.	Print the current time using time module.
	b.	Display the calendar of given month of the year using calendar module.
10.	Write a Python program to find the most frequent words from a file.	

Course Outcomes : Students will be able to	
CO1	Develop basic Python programs.
CO2	Construct Python programs using control statements.
CO3	Experiment with user defined functions and different types of function arguments.
CO4	Build python programs with modules.
CO5	Develop Python application using file operations.

List of Equipment Required : Requirements for a Batch of 30 Students

Sl. No.	Description of the Equipment	Quantity required
1.	Dell Optiplex 380 PCs Operating systems: Windows* 7 or later, macOS, and Linux. Python* versions: 2.7.X, 3.6.X.,3.8.X	30

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B.E / B.Tech	B19MCP101 - LIFE SKILLS (Common to all Branches)	T	P	TU	C
		0	2	0	0

Course Objectives	
1.	To make the students to enhance their attitude, confidence and communication.

UNIT - I	TRANSITION MANAGEMENT	6
Getting started-Getting involved- being responsible-adapting to the new environment.		

UNIT - II	VISION AND GOAL	6
Defining Vision and designing Goals in accordance-Seeing College life as a path towards Lifetime Goals.		

UNIT - III	VALUES VIRTUES	6
Not as preaching but a way of life to succeed in all aspects of life.		

UNIT - IV	FOCUS	6
Focus on basic quality in all activities .Tips to enhance memory and focus skills.		

UNIT - V	LEARNING SKILLS AND PASSIONATE LEARNER	6
Transforming information into knowledge and learning to read people like a book - hedding out inhibitions - Blossoming with talent and leadership abilities.		
		Total Instructional hours : 30

Course Outcomes : Students will be able to	
CO1	Develop the adapting skills to various environments.
CO2	Identify the Vision and Goal towards success.
CO3	Build Values and Virtues to succeed in life.
CO4	Develop focus in all activities.
CO5	Develop knowledge to understand various kinds of people.

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Semester - II

B.E / B.Tech	B19ENT201 - PROFESSIONAL ENGLISH (Common to all Branches)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
2.	Foster their ability to write convincing job applications and effective reports.
3.	Develop their speaking skills to make technical presentations, participate in group discussions.
4.	Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.
5.	Develop and integrate the use of the four language skills i.e. Reading, Listening, Speaking, Writing.

UNIT - I	12
Listening	Listening to motivational speech
Speaking	Asking for and giving directions
Reading	Reading short technical texts from newspapers and magazines
Writing	Extended definitions, Gerunds & Infinitives, writing checklists, recommendation
Vocabularydevelopment	Technical vocabulary, abbreviations
Language development	Subject verb agreement

UNIT - II	12
Listening	Listening to TED talks
Speaking	Describing a process, narrating a story
Reading	Reading longer technical texts, summarizing
Writing	Interpreting charts, graphs
Vocabularydevelopment	Vocabulary used in formal letters/emails and reports
Language development	British and American spelling, numerical adjectives.

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UNIT - III		12
Listening	Listening to classroom lectures, commentaries and announcements	
Speaking	Oral presentations	
Reading	Longer texts both general and technical, practice in speed reading	
Writing	process writing, use of sequence words, analytical essays and issue based essays	
Vocabularydevelopment	Sequence words, misspelled words.	
Language development	Identifying different types of sentences.	

UNIT - IV		12
Listening	Listening to documentaries, listening to resume preparation and making notes.	
Speaking	Techniques of effective presentations	
Reading	Reading for detailed comprehension	
Writing	Email etiquette, job application- cover letter, résumé preparation, Vocabulary	
Vocabularydevelopment	Finding suitable synonyms, paraphrasing	
Language development	Clauses, if conditionals	

UNIT - V		12
Listening	Listening to talks based on profession	
Speaking	Participating in a group discussion	
Reading	Reading and understanding technical articles	
Writing	Writing reports, minutes of a meeting, writing feasibility, survey and industrial reports	
Vocabularydevelopment	Verbal analogies	
Language development	Reported speech, active and passive voice, impersonal passive	
		Total Instructional hours : 60

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Course Outcomes : Students will be able to	
CO1	Develop their Vocabulary skills.
CO2	Develop their grammatical proficiency.
CO3	Develop strategies and skills to enhance their ability to read and comprehend.
CO4	Interpret graphical representation by comparing and contrasting the information.
CO5	Extend their knowledge through LSRW skills.

Text Books	
1.	Board of editors, “Fluency in English A Course Book for Engineering and Technology”, Orient Blackswan, Hyderabad: 2016.
2.	Sudharshana.N.P and Saveetha. C, “English for Technical Communication”, Cambridge University Press: New Delhi, 2016.

Reference Books	
1.	Raman, Meenakshi and Sharma, Sangeetha, “Technical Communication Principles and Practice”, Oxford University Press: NewDelhi, 2014.
2.	Kumar, Suresh. E, “Engineering English”, Orient Blackswan: Hyderabad, 2015
3.	Booth-L. Diana, “Project Work”, Oxford University Press, Oxford: 2014.

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B.E / B.Tech	B19MAT201 - INTEGRAL CALCULUS AND COMPLEX ANALYSIS (Common to all Branches)	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
2.	To make the student understand the mathematical tools needed in evaluating multiple integrals and their usage.
3.	To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
4.	To use the various methods of complex analysis efficiently for solving the problems that occurs in various branches of engineering disciplines.
5.	To develop an understanding of the standard techniques of complex integration so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.

UNIT - I	DEFINITE AND INDEFINITE INTEGRALS	12
Definite and Indefinite integrals - Substitution rule - Techniques of integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions.		

UNIT - II	MULTIPLE INTEGRALS	12
Double integrals: Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves - Triple integrals: Evaluation of triple integrals-Volume as triple integral (Simple problems).		

UNIT - III	VECTOR CALCULUS	12
Gradient and directional derivative - Divergence and curl - Solenoidal and Irrotational vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) - Verification of theorem and applications (for cubes and rectangular parallellopipeds).		

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UNIT - IV	COMPLEX DIFFERENTIATION	12
Analytic functions - Cauchy-Riemann equations (excluding proof) - Properties of analytic function - Harmonic conjugate- Construction of analytic function by Milne Thomson method - Bilinear transformation.		

UNIT - V	COMPLEX INTEGRATION	12
Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series - Singularities - Residues - Cauchy's Residue theorem -Evaluation of real integrals - use of circular contour and semicircular contour (excluding poles on real axis).		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Develop Fundamental Theorem of Calculus, techniques of Integration such as substitution, partial fractions and integration by parts.
CO2	Make use of integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
CO3	Apply the line, surface and volume integrals for verification of Green's, Gauss and Stokes theorems.
CO4	Construct Analytic function and develop Conformal Mapping.
CO5	Identify infinite series of a complex function within the contour and types of the singularities, finding of complex integrals.

Text Books	
1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

Reference Books

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1.	Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media - An imprint of Lakshmi Publications Pvt., Ltd., New Delhi, 7th Edition,2015.
2.	Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
3.	O‘Neil, P.V.,”Advanced Engineering Mathematics”, Cengage Learning India Pvt.Ltd, New Delhi, 7th Edition, 2017.
4.	Sastry, S.S, “Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5.	Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics”, Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
6.	Gean Duffy., “Advanced Engineering Mathematics with MATLAB”, A CRC Press Company, Boca Raton London, New York Washington, D.C, 2nd Edition, 2009.

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B.E / B.Tech	B19CHT101 - ENGINEERING CHEMISTRY (Common to all Branches)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
2.	To make the students conversant with basics of polymer chemistry.
3.	To make the students conversant with basic of electrochemical reactions and corrosion.
4.	To make the student acquire sound knowledge of energy devices.
5.	To develop an understanding of the basic concepts of nano materials.

UNIT - I	WATER TECHNOLOGY	9

Hardness of water : Types, Expression of Hardness and their units, boiler troubles Scale and sludge, caustic embrittlement, boiler corrosion, priming and foaming.
Water quality standards : WHO, BIS and CPCB
Treatment of Boiler feed water : Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning).
External treatment : Ion exchange process, Zeolite process.
Desalination of brackish water : Reverse Osmosis - Municipal water treatment, break point chlorination.

UNIT - II	POLYMERS AND COMPOSITES	9

Polymers : Definition, polymerization, types - addition and condensation polymerization - Tacticity - biodegradable and conducting polymers
Plastics : Classification, preparation, properties and uses of PVC, Teflon, Nylon-6,6 and Epoxy resin.
Rubber : Vulcanization of rubber, Synthetic rubbers - Butyl rubber, SBR.
Moulding : Ingredients - compression and Injection.
Composites : Definition, types, polymer matrix composites - FRP.

UNIT - III	ELECTROCHEMISTRY AND CORROSION	9

Electrochemistry : Redox reaction, Electrode potential - oxidation potential, reduction potential, Nernst equation (derivation) - Measurement and applications - Electrochemical Series and its significance.
Corrosion : causes- factors- types-chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection - sacrificial anode method and impressed current cathodic method.

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UNIT - IV	ENERGY DEVICES	9

Batteries : Types of batteries - Primary battery (dry cell), Secondary battery (lead acid battery, lithium-ion-battery), Fuel Cells- H_2 & O_2 fuel cell.
Super Capacitors : Principle, Construction, working and applications.
Photo voltaic cell : Solar cells - Principle, construction, working and applications.

UNIT - V	NANOCHEMISTRY	9

Basics - distinction between molecules, nanoparticles and bulk materials- Surface area to volume ratio - Quantum confinement (0D,1D,2D,3D) - Synthesis: Top down process (Ball milling) - Bottom up process (Chemical Vapour Deposition and Sol-Gel method) - properties of nano materials - optical, electrical, thermal and mechanical - applications (nano products of today)

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Outline the principle and characterization of water for the treatment of potable and industrial purposes.
CO2	Illustrate about the basics of Polymer Chemistry.
CO3	Relate the principles of electrochemical reactions and corrosion.
CO4	Outline the concepts of energy devices and its engineering applications.
CO5	Outline the basics of Nano-chemistry and its applications.

Text Books	
1.	Dara, S S and Umare, S S, "A Textbook of Engineering Chemistry", Chand S & Company Ltd., New Delhi, 2015.
2.	Jain, P C and Monika Jain, "Engineering Chemistry", DhanpatRai Publishing Company Pvt. Ltd., New Delhi, 2015
3.	Vairam, S Kalyani, P and Suba Ramesh, "Engineering Chemistry", Wiley India Pvt. Ltd., New Delhi, 2013.

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Reference Books	
1.	Friedrich Emich, “Engineering Chemistry”, Scientific International Pvt. Ltd., New Delhi, 2014.
2.	Prasanta Rath, “Engineering Chemistry”, Cengage Learning India Pvt. Ltd., Delhi, 2015.
3.	Shikha Agarwal, “Engineering Chemistry - Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.
4.	Charles P. Poole and Frank J. Owens, "Introduction to nanotechnology", John Wiley Sons, New Jersey, 2003.

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B.E / B.Tech	B19MET207 - FUNDAMENTALS OF CIVIL AND MECHANICAL ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart fundamental knowledge on Civil and Mechanical Engineering.
2.	To explain the surveying principle and materials used for the construction of civilized structures.
3.	To understand the fundamentals of building components.
4.	To explain the component of power plant units and detailed explanation to Cengines their working principles.
5.	To explain the Refrigeration and Air-conditioning System.

UNIT - I	SURVEYING AND CIVIL ENGINEERING MATERIALS	9

Surveying : Objects - types - principles
Civil Engineering Materials : Bricks - stones - sand - cement - concrete - steelsections

UNIT - II	BUILDING COMPONENTS AND STRUCTURES	9

Foundations : Types, Bearing capacity - Requirement of good foundations
Super structure : Brick masonry - stone masonry - beams - columns - lintels - roofing - flooring -plastering - Types of Bridges and Dams - Basics of Interior Design and Landscaping - stress - strain.

UNIT - III	POWER PLANT ENGINEERING	9

Introduction, Classification of Power Plants - Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants - working principle of Single acting Reciprocating pump,Centrifugal Pump and Pelton wheel turbine.

UNIT - IV	INTERNAL COMBUSTION ENGINES	9

Components of internal combustion engine - Working principle off our stroke petrol and diesel engines - Working principle of two stroke petrol and diesel engines - Comparison off our stroke and two stroke engines - Concept of Electrical and Hybrid vehicles.

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UNIT - V	REFRIGERATION AND AIR CONDITIONING SYSTEM	9
Terminology of Refrigeration and Air Conditioning. Layout of typical domestic refrigerator - Working Principle of vapour compression and absorption system (Liquid-Ammonia) -Working Principle of Window and Split type room Air conditioner		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the usage of construction material and proper selection of construction Materials.
CO2	Summarize the building structures.
CO3	Identify the components use in powerplant cycle.
CO4	Demonstrate working principles of petrol and diesel engine.
CO5	Outline the types and components of refrigeration and Air Conditioning cycle.

Text Books	
1.	Shanmugam G. and Palanichamy M.S., “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, 2016.
2.	Ramesh Babu V., “Basic Civil and Mechanical Engineering”, VRB Publishers Pvt. Ltd., Chennai, 2015.

Reference Books	
1.	Ramamrutham S., “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. 2013.
2.	Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies, 2015.
3.	Venugopal K. and Prahu Raja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam, 2018.
4.	Shantha Kumar SRJ., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2015.

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B.E.	B19EET201 - BASIC ELECTRICAL ENGINEERING	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To learn circuit laws, theorems and circuit solution methods.
2.	To educate on obtaining the transient response of circuits.
3.	To be able to analyze resonant circuits & coupled circuits.
4.	To analyze three phase circuits.
5.	To understand the safety practices and earthing.

UNIT - I	BASIC CIRCUIT ANALYSIS	12

Introduction to Electrical Power System - Circuit elements: R, L and C - Series parallel combination of R, L and C Components, DC Series - Parallel Circuits - sources: Independent and dependent voltage and current sources, Circuit laws - Voltage and current division - Use of source transformations - Mesh and Nodal analysis - Network reduction by delta-star transformations.Sinusoidal voltages and currents: Average and RMS Values, peak and form factors - impedance and admittance - Real, reactive and apparent power - Power factor and its practical importance.

UNIT - II	NETWORK THEOREMS	12

Network Theorems: Superposition theorem, Thevenin's Theorem, Norton's Theorem and Maximum power transfer theorem, Application to DC and AC networks.

UNIT - III	TRANSIENT RESPONSE ANALYSIS	12

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT - IV	RESONANCE AND COUPLED CIRCUITS	12

Series and parallel resonance - Frequency response - Quality factor and Bandwidth.Magnetically coupled circuits: self and mutual inductances, Dot rule for coupled circuits, coupled circuits analysis.

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UNIT - V	THREE PHASE CIRCUITS AND SAFETY PRACTICES	12
Three phase circuits: generation of 3 - phase voltages - star and delta connection - relation between phase and line quantities - balanced and unbalanced 3 - phase loads - power measurement by 2 - wattmeter method Electrical Safety Practices - Earthing		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Apply Circuit laws & Network reduction techniques to solve DC.
CO2	Apply network theorems to solve DC and AC circuits.
CO3	Solve the Transient response of RLC circuits using Laplace.
CO4	Analyze series and parallel resonant circuits and coupled circuits.
CO5	Analyze three phase circuits and interpret the electrical safety issues and earthing.

Text Books	
1.	William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "EngineeringCircuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2.	Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits",Second Edition, McGraw Hill, 2013.
3.	Peter E. Sutherland, 'Principles of Electrical Safety', John Wiley & Sons, 2014.

Reference Books	
1.	Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2015.
2.	Jegatheesan, R., "Analysis of Electric Circuits," McGraw Hill, 2015.
3.	Bhattacharya S.K. Basic Electrical and Electronics Engineering, Pearson India, 2011.
4.	Badri Ram, B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition 2011.

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B.E. / B.Tech.	B19HST201 - தமிழர் மரபு	T	P	TU	C
		1	0	0	1

அலகு - I	மொழி மற்றும் இலக்கியம்	3
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.		

அலகு - II	மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை	3
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கள், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.		

அலகு - III	நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்	3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.		

அலகு - IV	தமிழர்களின் திணைக் கோட்பாடுகள்	3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி		

அலகு - V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3
இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டில் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப் படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.		
		மொத்தம் - 15 காலங்கள்

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Text - Cum - Reference Books	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the Histroyb of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
11.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

BoS Chairman

B.E. / B.Tech.	B19HST201 - HERITAGE OF TAMILS (Common to all Branches)	T	P	TU	C
		1	0	0	1

UNIT - I	LANGUAGE AND LITERATURE	3
Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan		

UNIT - II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE	3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils		

UNIT - III	FOLK AND MARTIAL ARTS	3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils		

UNIT - IV	THINAI CONCEPT OF TAMILS	3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas		

UNIT - V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books		
		Total Instructional hours : 15

BoS Chairman

Text - Cum - Reference Books	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the Histroy of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
11.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

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B.E / B.Tech	B19CHP101 - CHEMISTRY LABORATORY (Common to all Branches)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To make the students to acquire practical skills in the determination of water quality parameters and estimation of ions through volumetric and instrumental analysis.

List of Experiments

Expt. No.	Description of the Experiments (Any 8 experiments)
1.	Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinityin water sample.
2.	Determination of total, temporary & permanent hardness of water by EDTA method.
3.	Determination of DO content of water sample by Winkler's method.
4.	Determination of chloride content of water sample by Argentometric method.
5.	Estimation of copper in brass.
6.	Determination of strength of given hydrochloric acid using pH meter.
7.	Estimation of iron content of the given solution using potentiometer.
8.	Estimation of iron content of the water sample using spectrophotometer (1,10-Phenanthroline/ thiocyanate method).
9.	Estimation of sodium and potassium present in water using flame photometer.
10.	Conductmetric titration of strong acid vs strong base
11.	Estimation of iodine in common salt.
12.	Estimation of calcium in milk powder.
	Total Instructional hours : 60

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Course Outcomes : Students will be able to	
CO1	Relate the acquired knowledge in the quantitative estimation of alkalinity, hardness, DO and chloride ion present in the water samples.
CO2	Interpret the nature of water quality parameters to find the pollution level in water.
CO3	Estimate the amount of copper, iodine, calcium in alloys and food products.
CO4	Apply the spectroscopic techniques for the quantitative estimation of sodium, potassium and Ferrous ion.
CO5	Analyze the solutions by electrochemical parameters like conductivity, pH and EMF.

List of Equipment Required : Requirements for a Batch of 30 Students

Sl. No.	Description of the Equipment	Quantity required
1.	pH Meter	10
2.	Conductivity Meter	10
3.	Flame Photometer	2
4.	Potentiometer	10
5.	Spectrophotometer	2
6.	Electronic Balance	1

	Text Books
1.	Vogel's Textbook of Quantitative Chemical Analysis, 8th edition, 2014.

BoS Chairman

B.E.	B19EEP201 - CIRCUITS AND SIMULATION LABORATORY	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To impart hands on experience in verification of Electric Circuit laws and Theorems.
2.	To verify Electric Circuit laws and theorems using simulation software.
3.	To implement power measurement methods for three phase circuits.

Expt. No.	Description of the Experiments
1.	Verification of Kirchhoff's Voltage and Current Laws.
2.	Verification of Thevinin's and Norton's Theorem.
3.	Verification of Superposition and Maximum Power Transfer Theorem.
4.	Study of the effect of Q on frequency response of series and parallel resonant circuits.
5.	Measurement of active power, reactive power, power factor and impedance of RL, RC and RLC circuits using 3 voltmeters and 3 ammeters.
6.	Power measurement in a three phase circuit using two wattmeter method.
7.	Verification of Kirchhoff's Voltage and Current Laws using a simulation software.
8.	To obtain Thevenin's and Norton's equivalent circuits using a simulation software.
9.	To verify Maximum power Transfer theorem and Superposition theorem using a simulation software.
10.	Simulation of three phase power measurement by two wattmeter method using a simulation software.
	Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Analyze basic laboratory experiments involving electrical circuits using laboratory test equipments such as power supplies, signal generators, oscilloscopes and multimeters.
CO2	Examine and verify network theorems.
CO3	Examine the three phase power measurement method using two wattmeter method.

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CO4	Relate physical observations and measurements involving electrical circuits to theoretical principles.
CO5	Experiment with various electric circuits for the performance evaluation using simulation software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of the Equipment	Quantity required
1.	Regulated Power Supply (0-30V)	15 Nos.
2.	Function Generator (MHz Range)	10 Nos.
3.	Oscilloscope (20 MHz)	10 Nos.
4.	Digital Storage Oscilloscope (20 MHz)	2 Nos.
5.	AC/DC - Voltmeters of required rating	10 Nos.
6.	AC/DC -Ammeters of required rating	10 Nos.
7.	Multimeters	10 Nos.
8.	Decade Resistance Box	6 Nos.
9.	Decade Inductance Box	6 Nos.
10.	Decade Capacitance Box	6 Nos.
11.	Single Phase Wattmeter of suitable rating	5 Nos.
12.	Circuit Connection Boards	20 Nos.
13.	Three phase star& delta connected load / Single phase load bank of suitable rating	3 Nos.
14.	Resistors, Inductors, Capacitors of various capacities (Quarter Watt to 10 Watt)	50 Nos.
15.	10 Nos of PC loaded with Pspice/ Matlab/e-Sim / Scilab/ Equivalent Software Package	Minimum 10 Users
16.	Printer	1 No.

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B.E. / B.Tech	B19MEP201 - BASIC WORKSHOP PRACTICE LABORATORY (GROUP-A & B) (Common To all Branches)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical Engineering.
2.	To provide exposure to the students with hands on experience on various basic engineering practices in Electrical Engineering.
3.	To provide exposure to the students with hands on experience on various basic engineering practices in Electronics Engineering.

GROUP - A (CIVIL & MECHANICAL)

I Civil Engineering Practices	12

Plumbing Works

Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings.

Carpentry

Preparation of wooden joints by sawing, planning and cutting

1. Planning & Polishing operation
2. Half lap joint
3. Cross lap joint

II Mechanical Engineering Practices	18

Welding Workshop

Study of welding tools and equipment's - Study of various welding methods - Instruction of BI standards and reading of welding drawings.

Exercise in arc welding for making

1. Lap joint
2. Butt joint
3. Demonstration of gas welding and cutting.

Machine Shop

1. Drilling and Tapping
2. Lathe Exercise - Facing operation
3. Lathe Exercise - Straight turning and Chamfering

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Sheet metal

Making of small parts using sheet metal

1. Tray Funnel

GROUP - B (ELECTRICAL & ELECTRONICS)		
Sl. No.	**Description of the Equipment**	**30**
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter.	
2.	Fluorescent lamp and Stair case wiring.	
3.	Measurement of electrical quantities - voltage, current, power & power factor in RLC circuit.	
4.	Measurement of energy using single phase energy meter.	
5.	Measurement of resistance to earth of an electrical equipment.	
6.	Study of Electronic components and equipment's - Resistor color coding	
7.	Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.	
8.	Study of logic gates AND, OR, EX-OR and NOT.	
9.	Soldering & de-soldering practices.	
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Explain the pipe connections and identify the various components used in plumbing.
CO2	Examine simple wooden joints using wood working tools and simple components using lathe and drilling machine.
CO3	Analyze simple lap, butt and tee joints using arc welding equipment and simple parts using sheet metal.
CO4	Interpret Residential house wiring, Fluorescent lamp wiring and Stair case wiring.
CO5	Measure electrical quantities such as voltage, current, power & power factor in RLC Circuit, resistance to earth, AC signal parameter (peak-peak, RMS period, frequency) and ripple factor.
CO6	Assess logic gates (AND, OR, EOR and NOT), Electronic components and equipment's.

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LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS			
GROUP - A (CIVIL & MECHANICAL)			
Sl. No.	Description of the Equipment		Quantity required
1.	Assorted components for plumbing, Consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.		15
2.	Carpentry vice (fitted to work bench)		15
3.	Standard woodworking tools		15
4.	Models of industrial trusses, door joints, furniture joints		5
5.	Power Tools:		
	a.	Rotary Hammer	2
	b.	Demolition Hammer	2
	c.	Circular Saw	2
	d.	Planer	2
	e.	Hand Drilling Machine	2
	f.	Jigsaw	2
6.	Arc welding transformer with cables and holders		5
7.	Welding booth with exhaust facility		5
8.	Welding accessories like welding shield, chipping hammer, wire brush, etc.		5
9.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.		2
10.	Centre lathe		2
11.	Hearth furnace, anvil and smithy tools		2
12.	Moulding table, foundry tools		2
13.	Power Tool: Angle Grinder		2
14.	Study-purpose items: Centrifugal pump, Airconditioner		1

BoS Chairman

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
GROUP - B (ELECTRICAL & ELECTRONICS)		
Sl. No.	**Description of the Equipment**	**Quantity required**
1.	Assorted Electrical Components for House Wiring	15 sets
2.	Electrical Measuring Instruments	10 sets
3.	Iron Box	1
4.	Fan and Regulator	1
5.	Emergency Lamp	1
6.	Megger	1
7.	Digital Live Wire Detector	2
8.	Soldering Guns	10
9.	Assorted Electronic Components for Making Circuits	50
10.	Multipurpose PCBs	10
11.	Multi Meters	10
12.	Telephone	2
13.	FM radio	2
14.	Regulated Power Supply	2
15.	CRO (30MHz)	2
16.	Bread board	10
17.	Digital IC types (IC 7432, IC 7408, IC 7400, IC 7404, IC 7402, IC 7486)	Each 10

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B.E / B.Tech	B19CEP201 - SOFT SKILLS - I	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To Develop the inter personal skills.
2.	To Develop creativity skills.
3.	To Enhance communication and problem solving skills.
4.	To Improve emotional maturity and emotional health.
5.	To Enhance the Employability and Career Skills of students.

UNIT - I	SELF EVALUATION	6
Introducing to soft skills, familiarize yourself, Self-understanding, SWOT analysis, Goal Setting.		

UNIT - II	INNOVATIVE THINKING	6
Divergent thinking, Encourage curiosity, Write your story, Poster making		

UNIT - III	COMMUNICATION SKILLS	6
Just a Minute, workplace communication, Role Play, Extempore, Effectiveness of body language.		

UNIT - IV	EMOTIONAL INTELLIGENCE	6
Personal etiquette and relationship, Stress and Time Management.		

UNIT - V	PERSONALITY DEVELOPMENT	6
Leadership skills, Managerial skills, corporate etiquette, Team Building Language Development.		
Total Instructional hours : 30		

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Course Outcomes : Students will be able to	
CO1	Develop the Interpersonal Skills.
CO2	Show the creative skill in different aspects.
CO3	Explain their ideas through conversations.
CO4	Develop adequate Soft Skills required for the workplace.
CO5	Develop leadership qualities.

Reference Books	
1.	Butterfield, Jeff, “Soft Skills for Everyone”, Cengage Learning, New Delhi, 2015.
2.	S. Hariharanetal, “Soft Skills”, MJP Publishers: Chennai, 2010.
3.	Peter, Francis, “Soft Skills and Professional Communication”, New Delhi: Tata McGraw Hill, 2012.

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Semester - III

B.E. - AERO, AGRI & EEE	B19MAT303 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To introduce the basic concepts of PDE for solving standard partial differential equations.
2.	To understand Fourier series analysis in representation of Periodic signals.
3.	To develop Fourier series techniques in solving wave and heat flow problems.
4.	To acquaint the student with Fourier transform techniques used in wide variety of situations.
5.	To develop the concept of Z transforms techniques for discrete time systems.

UNIT - I	PARTIAL DIFFERENTIAL EQUATIONS	12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of first order partial differential equations of the forms f(p,q) = 0, z = px + qy + f(p,q), -Lagrange's linear equation - Linear homogeneous partial differential equations of second and higher order with constant coefficients.

UNIT - II	FOURIER SERIES	12

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range sine series - Half range cosine series - Complex form of Fourier series -Parseval's identity - Harmonic analysis.

UNIT - III	BOUNDARY VALUE PROBLEMS	12

Classification of second order linear PDE - Method of separation of variables - Solutions of one dimensional wave equation - One dimensional equation of heat conduction - Steady state solution of two dimensional equation of heat conduction - Fourier series solutions in Cartesian coordinates.

UNIT - IV	FOURIER TRANSFORMS	12

Statement of Fourier integral theorem-Fourier transform pair - Fourier sine and cosine transforms - Properties(excluding proof) - Transforms of simple functions - Convolution theorem(without proof) - Parseval's identity

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UNIT - V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	12
Z - transforms - Elementary properties - Inverse Z-transform (using partial fraction and residues) - Initial and final value theorems-Convolution theorem (without proof) - Formation of difference equations - Solution of difference equations using Z - transform.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Solve the partial differential equations with constant coefficients.
CO2	Solve differential equations using Fourier series analysis.
CO3	Apply Fourier series to solve boundary value problems.
CO4	Experiment with Fourier transforms techniques in engineering problems.
CO5	Make use of Z- transforms to solve difference equations.

Text Books	
1.	Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2020.
2.	Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics" Volume III, S. Chand & Company Ltd., 2016.

Reference Books	
1.	Ramana B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
3.	James G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007. Publications Pvt. Ltd, 2014.
4.	Wylie C. Ray and Barrett Louis C.,"Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

BoS Chairman

B.E.	B19EET301- FIELD THEORY	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To introduce the basic mathematical concepts related to electromagnetic vector fields.
2.	To provide knowledge on the concepts of electrostatics, electrical potential, energy density and their application.
3.	To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
4.	To impart knowledge on the concepts of Faraday's law, induced EMF and Maxwell's equations.
5.	To impart knowledge on the Concepts of electromagnetic waves and Poynting vector.

UNIT - I	ELECTROSTATICS - I	12

Sources and Effects of Electromagnetic Fields - Vector Algebra - Gradient, Divergence and Curl - Coordinate Systems - Divergence theorem - Stoke's theorem, Types of charge distributions - Coulomb's law - Electric field intensity - Electric flux density - Gauss's law and its applications.

UNIT - II	ELECTROSTATICS - II	12

Electric potential - Equipotential plots, Uniform and Non-Uniform fields, Utilization factor - Poisson's and Laplace's equations-Polarization-Dielectric Strength-Electric dipole - Capacitance for different configurations - Method of images - Electrostatic energy and Energy density - Boundary conditions.

UNIT - III	MAGNETOSTATICS	12

Magnetic flux and magnetic flux density - Biot - Savart's Law - Ampere's Circuital Law - Lorentz law of force - Magnetic flux density and magnetic field intensity due to straight conductors, circular coil and Solenoid coil - Magnetization-Magnetic force - Magnetic torque - Scalar and vector magnetic potentials - Inductance due to solenoid and toroid - Magneto static energy and energy density - Boundary conditions.

UNIT - IV	ELECTRODYNAMIC FIELDS	12

Magnetic Circuits - Faraday's law - Transformer and motional EMF - Maxwell's equations (differential and integral forms) - Maxwell's equations for harmonically varying fields - Relation between field theory and circuit theory.

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UNIT - V	ELECTROMAGNETIC WAVES	12
Electromagnetic Wave Generation and equations - Wave parameters; velocity, intrinsic impedance, propagation constant and skin depth -Electromagnetic waves in good conductor, lossy and lossless dielectrics-Poynting theorem-Poynting vector -Standing wave ratio.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Apply vector calculus concepts to solve electromagnetic field problems.
CO2	Apply Coulomb's law, Gauss's law, Poission's and Laplace equations to solve electrostatic problem.
CO3	Apply Biot-Savart's law and Ampere 's circuital law to determine magnetic field intensity and magnetic flux density problems.
CO4	Make use of Capacitance and Inductance concepts to solve Electromagnetic field problems.
CO5	Apply Maxwell's equations to derive Electromagnetic wave equations in various medium.

Text Books	
1.	William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill, 8^{th} Revised edition, 2011.
2.	Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition ,Oxford University Press Inc First India edition, 2009.
3.	AshutoshPramanik, 'Electromagnetism - Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition - 2009.

Reference Books	
1.	Joseph. A. Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010.
2.	Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
3.	Bhag Singh Guru and Hussein R. Hiziroglu "Electromagnetic field theory fundamentals", Cambridge University Press; Second Revised Edition, 2009.
4.	K.A. Gangadhar, P.M. Ramanathan 'Electromagnetic Field Theory (including Antenna's and wave propagation', 16^{th} Edition, Khanna Publications, 2007.

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B.E.	B19EET302 - ELECTRONIC DEVICES AND INTEGRATED CIRCUITS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic concepts of semiconductor devices.
2.	To study the concepts of biasing and the frequency response of amplifiers using BJT and FET.
3.	To learn about positive and negative feedback amplifiers.
4.	To understand about IC fabrication procedure.
5.	To study about the basics of Op - Amp and its applications.

UNIT - I	SEMICONDUCTOR DEVICES	9
PN junction Diode - ZenerDiode - BJT - JFET - MOSFET - Structure, Operation and VI Characteristics - Applications of Diode: Half Wave &Full Wave Rectifier - Zener voltage regulator.		

UNIT - II	SMALL SIGNAL AMPLIFIERS USING BJT AND FET	9
Need for Biasing, Q-point, DC and AC Loadline, Biasing Circuits - Base bias, Voltage divider bias, emitter bias, CE,CB Amplifiers - Frequency response and hybrid model of CE amplifier - FET amplifier: CS Amplifier, Multistage Amplifier: RC coupled amplifier, Darlington Amplifier, Differential Amplifier using BJT.		

UNIT - III	LARGE SIGNAL, FEEDBACK AMPLIFIERS AND OSCILLATORS	9
Classification of Amplifiers - Push-pull Amplifiers: A, B & AB Amplifiers - Tuned Amplifiers: Single Tuned Amplifiers - Advantages of Negative Feedback-Topologies of Voltage/Current: Series & Shunt Feedback Amplifiers - Positive Feedback-BarkhausenCriteria - Operation of RC phase shift, Wien Bridge, Crystal Oscillators.		

UNIT - IV	IC FABRICATION AND OPERATIONAL AMPLIFIER	9
Fundamental of monolithic IC fabrication technology- realization of monolithic ICs - Op-Amp - characteristics - Basic operations of Op-Amp - Inverting, Non-inverting, Differentiator, Integrator - Differential Amplifier using Op-Amp - Op-Amp Based Instrumentation Amplifier - Comparator - Multivibrators - Schmitt trigger.		

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UNIT - V	SIGNAL CONVERSION CIRCUITS AND SPECIAL ICs	9
First and second order active filters - V/I and I/V conversion - S/H Circuit- D/A converter (R-2R ladder and weighted resistor types), A/D converters using opamps - IC 555 Timer circuit: Functional block, characteristics & applications, IC566 - voltage controlled oscillator, IC565 - phase locked loop circuit, IC voltage regulators - LM78XX, LM79XX, LM317, IC723, SMPS.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Demonstrate the characteristics and applications of various semiconductor devices.
CO2	Explain about biasing and the frequency responses of BJT and FET amplifiers.
CO3	Construct negative feedback amplifier and oscillator circuits.
CO4	Outline the IC fabrication procedure.
CO5	Develop the linear integrated circuits using Op - amp.

Text Books	
1.	S. Salivahanan, N. SureshKumar, “Electronic Devices and Circuits”, McGraw-Hill Education, 2018.
2.	Thomas L.Floyd, “Electronic Devices (Conventional Current Version)”, 10th Edition, Pearson education, 2017.
3.	D. Roy Choudhary, Sheil B. Jani, “Linear Integrated Circuits”, 4th Edition, New Age International, New Delhi, 2010.
4.	David A. Bell, ˆOperational amplifiers &Linear ICs, Oxford University Press, 2010.

Reference Books	
1.	Jacob Millman, Christos C.Halkias, SatyabrataJit, “Electronic Devices and Circuits”, Tata McGraw Hill Publishing Limited, New Delhi, 2015.

BoS Chairman

2.	David A. Bell, “Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2008.
3.	B.P.Singh, Rekha Singh, “Electronic Devices and Integrated Circuits”, 2nd Edition, Pearson Education, 2009.
4.	Adel S. Sedra,KennethC.Smith&ArunN. Chandorkar, “Microelectronic Circuits”, 6th Edition, Oxford University Press, 2013.
5.	Muhammad H. Rashid, Microelectronic Circuits Analysis and Design, Cengage Learning, 2011.
6.	Ramakant A. Gayakward, “Op-amps and Linear Integrated Circuits”, 4th Edition, Pearson Education, New Delhi, 2009.

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B.E.	B19EET303 - MEASUREMENTS AND INSTRUMENTATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart knowledge on various instrument systems and their errors in them.
2.	To understand students how different types of meters work and their construction.
3.	To introduce students a knowledge on various storage and display devices.
4.	To impart knowledge on various transducers and data acquisition systems.

UNIT - I	INTRODUCTION	9

Roles and needs of instrumentation - Classification of Instrument - Functional elements of an instrument - Static & Dynamic characteristics - Errors in measurement - Statistical evaluation of measurement data - Standards & Calibration.

UNIT - II	ANALOG & DIGITAL INSTRUMENTS	9

Analog Instruments : Construction, Principle and applications of Moving coil instrument - Moving iron instrument - Dynamometer type instrument - Induction type instrument - Selection of a measuring instrument for a specific application.

Digital Instruments : Digital Voltmeter - Digital Ammeter - Digital Multimeters - Digital Wattmeter - Digital frequency meter - LCR meter - Energy meter - Power factor meter - Harmonic analyzer - Concepts of smart meters - Automatic Meter Reading (AMR) - Net metering. Instrument Transformer.

UNIT - III	DC & AC NULL MEASUREMENTS &IT'S APPLICATIONS	9

Wheatstone bridge, Kelvin bridge - Schering bridge, Wein's bridge - Maxwell's bridge, Hay's bridge, Anderson bridge - Selection of a suitable bridge for specific application (eg. Cable fault identification).

UNIT - IV	STORAGE AND DISPLAY DEVICES	9

Magnetic disk and tape - Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display - Data Loggers.

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UNIT - V	SENSORS, TRANSDUCERS & DATA ACQUISITION SYSTEMS	9
Classification of transducers - Selection of transducers - Resistive, Capacitive & Inductive transducers - Piezoelectric, Hall effect, Optical and digital transducers - Data Acquisition System: Introduction -Types - Block diagram - Elements of single and multi-channel data acquisition system - Shaft Encoder - Intelligent sensors - Biosensors - Thermal imager.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the functional blocks of various Instruments and their Standards.
CO2	Compare type of instruments, their working principle, advantages and disadvantages.
CO3	Identify different bridges for measuring R,L,C and frequency for the required specifications.
CO4	Explain about operational features of various storage and display devices.
CO5	Identify the transducers for physical variables and to describe operating principle and understand the data acquisition systems.

Text Books	
1.	A.K. Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co,2010.
2.	J.B. Gupta, "A Course in Electronic and Electrical Measurements", S.K. Kataria & Sons, Delhi, 2013.
3.	Doebelin E.O. and Dhanesh N Manik , "Measurement Systems", McGraw Hill, New Delhi 2012.

Reference Books	
1.	H.S.Kalsi, " Electronic Instrumentation ", McGraw Hill, III Edition 2010.
2.	D.V.S Murthy, " Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd., 2015.
3.	David A. Bell, "Electronic Instrumentation and Measurements", Oxford University Press, New Delhi, 2012.

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B.E.	B19EET304 - DC MACHINES AND TRANSFORMERS	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To provide students with a strong back ground in different types of electrical machines.
2.	To provide knowledge about the magnetic circuits and Material.
3.	To understand the basic concepts of DC Machines.
4.	To understand the basic components of Transformer.
5.	To Analyze the testing of DC Machines and Transformer.

UNIT - I	MAGNETIC CIRCUITS AND MAGNETIC MATERIALS	12

Magnetic circuits - Laws governing magnetic circuits - Flux linkage, Inductance and energy - Statically and Dynamically induced EMF - Torque - Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets - Transformer as a magnetically coupled circuit.

UNIT - II	DC GENERATORS	12

Construction and components of the DC Machine - Principle of operation - Lap and wave windings - EMF equations - circuit model - armature reaction - methods of excitation - commutation and interpoles - compensating winding - Parallel operation - characteristics of DC generators.

UNIT - III	DC MOTORS	12

Principle and operations - types of DC Motors - Speed Torque Characteristics of DC Motors - starting and speed control of DC motors - Plugging, dynamic and regenerative braking - Permanent magnet DC motors (PMDC) - DC Motor applications.

UNIT - IV	TRANSFORMERS	12

Construction - principle of operation - equivalent circuit parameters - phasor diagrams, losses -efficiency and voltage regulation - all day efficiency-three phase transformers - connections - Scott Connection - Phasing of transformer - parallel operation of three phase transformers - auto transformer - tap changing transformers.

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UNIT - V	TESTING OF DC MACHINES AND TRANSFORMERS	12
DC Machines - Losses and Efficiency - Brake test, Retardation test, Swinburne's test and Hopkinson's test-Separation of no load losses. **Transformers** Losses and Efficiency - Open circuit test, Short circuit test, Load test, Sumpner's test and Polarity test.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Infer the laws governing magnetic circuits and properties of magnetic materials.
CO2	Apply the knowledge in working principles of DC Generator, Characteristics and its types.
CO3	Apply the knowledge in working principles of DC motor, Characteristics and speed control.
CO4	Explain the different types of transformer with its construction, working principle, equations, characteristics and applications.
CO5	Identify the losses and performance of various electrical machines by conducting different testing methods.

Text Books	
1.	Stephen J. Chapman, 'Electric Machinery Fundamentals' 4th edition, McGraw Hill Education Pvt. Ltd, 2010.
2.	P.C. Sen'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.
3.	Nagrath, I.J. and Kothari D.P., Electric Machines', McGraw-Hill Education, 2004.

Reference Books	
1.	B.R. Gupta, 'Fundamental of Electric Machines' New age International publishers, 3rd Edition, Reprint 2015.
2.	S.K. Bhattacharya, 'Electrical Machines' McGraw - Hill Education, New Delhi, 3rd Edition,2009.
3.	Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
4.	Surinder Pal Bali, 'Electrical Technology Machines & Measurements, Vol.II, pearson, 2013.

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B.E. / B.Tech	B19MCT301 - ENVIRONMENTAL SCIENCES	T	P	TU	C
		3	0	0	NC

Course Objectives	
1.	To study the nature and facts about environment.
2.	To find and implement scientific, technological, economic and political solutions to environmental problems.
3.	To study the interrelationship between living organism and environment.
4.	To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5.	To study the dynamic processes and understand the features of the earth‟s interior and surface.

UNIT - I	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	9

Definition, scope and importance of environment - need for public awareness - concept of anecosystem - structure and function of an ecosystem - producers, consumers and decomposers - energy flow in the ecosystem - ecological succession - food chains, food webs and ecologicalpyramids - Introduction, types, characteristic features, structure and function of the (a) forestecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams,lakes, rivers, oceans, estuaries) - Introduction to biodiversity definition: genetic, species andecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use,productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and locallevels - India as a mega-diversity nation - hot-spots of biodiversity - threats to biodiversity: habitatloss, poaching of wildlife, man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of commonplants, insects, birds; Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT - II	ENVIRONMENTAL POLLUTION	9

Definition - causes, effects and control measures of : (a) Air pollution (b) Water pollution (c) Soilpollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards - solid wastemanagement: causes, effects and control measures of municipal solid wastes - role of an individual inprevention of pollution - pollution case studies - disaster management: floods, earthquake, cycloneand landslides. Field study of local polluted site - Urban / Rural / Industrial / Agricultural.

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UNIT - III	NATURAL RESOURCES	9
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining,dams and their effects on forests and tribal people - Water resources: Use and over- utilization ofsurface and ground water, floods, drought, conflicts over water, dams-benefits and problems - Mineralresources: Use and exploitation, environmental effects of extracting and using mineral resources,case studies - Food resources: World food problems, changes caused by agriculture andovergrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, casestudies - Energy resources: Growing energy needs, renewable and non renewable energy sources,use of alternate energy sources. case studies - Land resources: Land as a resource, land degradation,man induced landslides, soil erosion and desertification - role of an individual in conservation ofnatural resources - Equitable use of resources for sustainable lifestyles. Field study of local area todocument environmental assets - river / forest / grassland / hill / mountain.		

UNIT - IV	SOCIAL ISSUES AND THE ENVIRONMENT	9
From unsustainable to sustainable development - urban problems related to energy - waterconservation, rain water harvesting, watershed management - resettlement and rehabilitation ofpeople; its problems and concerns, case studies - role of non-governmental organization 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 production act - Air (Prevention and Control ofPollution) act - Water (Prevention and control of Pollution) act - Wildlife protection act - Forestconservation act - enforcement machinery involved in environmental legislation- central and statepollution control boards- Public awareness.		

UNIT - V	HUMAN POPULATION AND THE ENVIRONMENT	9
Population growth, variation among nations - population explosion - family welfare programme -environment and human health - human rights - value education - HIV / AIDS - women and childwelfare - role of information technology in environment and human health - Case studies.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the basic concepts of environment, ecosystem and biodiversity.
CO2	Recognize thedifferent types of pollution and their control measures.

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CO3	Discussvarious natural resources.
CO4	Summarize Development and improvement in the standard of living that has lead to serious environmental disasters.
CO5	Explain the causes of population and role of Information technology in environment.

Text Books	
1.	Benny Joseph, "Environmental Science and Engineering", Tata McGraw - Hill, New Delhi, 2006.
2.	Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.

Reference Books	
1.	Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
2.	Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) PVT, LTD, Hydrabad, 2015.
3.	Rajagopalan, R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2005.
4.	G.Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt, Ltd, Delhi, 2014.

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B.E. / B.Tech.	B19HST301 - தமிழரும் தொழில்நுட்பமும்	T	P	TU	C
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அலகு - I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு - II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோவில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை

அலகு - III	உற்பத்தித் தொழில் நுட்பம்	3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருவாக்குதல், எ∴கு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்

அலகு - IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்	3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக் குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்

அலகு - V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ்	3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின் பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்

மொத்தம் - 15 காலங்கள்

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Text - Cum - Reference Books	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL
6.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the Histroy of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
11.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

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B.E. / B.Tech.	B19HST301 - TAMILS AND TECHNOLOGY	T	P	TU	C
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UNIT - I	WEAVING AND CERAMIC TECHNOLOGY	3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries		

UNIT - II	DESIGN AND CONSTRUCTION TECHNOLOGY	3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period		

UNIT - III	MANUFACTURING TECHNOLOGY	3
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel - Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram		

UNIT - IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society		

UNIT - V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project		
		Total Instructional hours : 15

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Text - Cum - Reference Books	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the Histroyb of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
11.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

BoS Chairman

B.E.	B19EEP301- DC MACHINES AND TRANSFORMERS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To learn the working and testing methods of dc machines.
2.	To learn the working and testing methods of transformers.
3.	To study the various starters and transformer connections.

List of Experiments

Expt. No.	Description of the Experiments
1.	Study of Starters.
2.	Open circuit and load characteristics of DC Shunt Generator.
3.	Load characteristics of DC Series Generator.
4.	Load characteristics of DC compound generator with differential and cumulative connections.
5.	Load test on DC Machines (Shunt, Series and Compound).
6.	Speed control of DC Shunt motor.
7.	Swinburne's test.
8.	Load test on single phase transformer.
9.	Load test on three phase transformer.
10.	Parallel operation (DC Generator and Transformer)
11.	Open circuit and short circuit tests on single phase transformer.
12.	Sumpner's test on single phase transformers.
13.	Separation of no load losses in single phase transformer.
14.	Study on three phase transformers.
15.	Performance Analysis of DC Machines using Simulation software.
	Total Instructional hours : 60

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Course Outcomes : Students will be able to	
CO1	Analyze the performance of DC generators/ motors by conducting direct load test experimentally.
CO2	Compare the performance characteristics obtained experimentally and Simulation on various DC machines and select the suitable DC machines for industrial applications.
CO3	Examine the performance of DC machines by conducting Swinburne's Test.
CO4	Analyze the performance of transformer by conducting direct load test experimentally.
CO5	Examine the performance of transformers by conducting open circuit and short circuit tests.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the Equipment	Quantity required
1.	Dc Shunt Motor With Loading Arrangement	3 Nos.
2.	Single Phase Transformer	4 Nos.
3.	DC Series Motor With Loading Arrangement	1 Nos.
4.	DC Compound Motor With Loading Arrangement	1 Nos.
5.	DC Shunt Motor Coupled With DC Compound Generator	1Nos.
6.	Tachometer -Digital/Analog	8 Nos.
7.	Single Phase Auto Transformer	2 Nos.
8.	Three Phase Auto Transformer	2 Nos.
9.	Single Phase Resistive Loading Bank	2 Nos.
10.	Three Phase Resistive Loading Bank	2 Nos.
11.	SPST Switch	2 Nos.
12.	DC Shunt Motor Coupled With DC Series Generator	1 Nos.

BoS Chairman

B.E.	B19EEP302 - MEASURMENTS AND INSTRUMENTATION LABORATORY	T	P	TU	C
		0	2	0	2

Course Objectives	
1.	To understand the working of DC and AC bridges.
2.	To understand the use of sensors, transducers and measuring instruments.
3.	To gain hands on experience in different measuring devices.
4.	To gain hands on experience in LabVIEW software.

List of Experiments

Expt. No.	Description of the Experiments
1.	AC and DC bridges
2.	Study of Displacement and Pressure Transducers
3.	Study the characteristics of RTD and Thermistor
4.	Study the characteristics of Strain Gauge, Optical Sensor and Flow Sensor
5.	Instrumentation Amplifier
6.	Analog - Digital Converter (ADC)
7.	Digital - Analog Converter (DAC)
8.	Temperature Control using LabVIEW
9.	Water Tank Level control using LabVIEW
10.	Virtual Function generator using LabVIEW
11.	Study the performance and transformation ratio of Current Transformer
	Total Instructional hours : 30

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Course Outcomes : Students will be able to	
CO1	Make use of AC and DC bridges to measure resistance, inductance and capacitance.
CO2	Analyze the characteristics of Instrumentation amplifier & Sensors / Transducers for physical variables.
CO3	Experiment withAnalog to Digital and Digital to Analog converters.
CO4	Interpret the performance of Current Transformer.
CO5	Utilize LabVIEW Software for Virtual function generator and for temperature and water level control.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	Name of the Equipment	Quantity required
1.	R, L, C Bridge kit	1
2.	LVDT 20mm core length Movable type	1
3.	Pressure Transducer kit with Air foot Pump and Pressure Chamber	1
4.	Electric Heater	1
5.	Thermometer	1
6.	Thermistor (Silicon type) RTD Nickel Type	1
7.	Optical Sensor	1
8.	Strain Gauge Kit with Handy lever beam	1
9.	100 gm weights	10
10.	Flow measurement Trainer Kit	1
11.	Instrumentation Amplifier Kit	1
12.	Analog to Digital and Digital to Analog Converters	1
13.	LabVIEW software	15
14.	Personal Computers	15
15.	Current Transformer	1
16.	Digital Multimeters	5
17.	CRO -30 MHz	2

BoS Chairman

B.E. / B.TECH	B19CEP301- SOFT SKILLS - II (Common to all Branches)	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To enhance communication skills through LSRW skills.
2.	To enrich interpersonal skills through integrated activities.
3.	To develop social and professional etiquette.
4.	To identify and apply employability skills for professional success.

UNIT - I	COMMUNICATION SKILLS	6
Define Listening - Types of Listening - Listening and Filling Information - Basis of Phonetics - Strategies of Effective Reading - Reading & Responding to Business Communications - E-mail.		
UNIT - II	**INTERPERSONAL SKILLS**	**6**
Interpersonal Skills - Need & Components - Understanding Inter cultural Competence - Team Work - Problem Solving Skills - Workplace Conflict Management & Resolutions.		
UNIT - III	**EMOTIONAL INTELLIGENCE**	**6**
Key Elements of Emotional Intelligence - Self Awareness - Self Performance - Psychometric Analysis - Relationship Management - Critical Thinking & Reasoning.		
UNIT - IV	**BUSINESS ETIQUETTE**	**6**
Define Etiquette - Types & Importance of Workplace Etiquette - Basic Corporate Etiquette - Telephone Etiquette - Meeting & E-mail Etiquette - Customer Service Etiquette.		
UNIT - V	**CORPORATE SKILLS**	**6**
Work Ethics - Adaptability - Analytical Reasoning - Lateral Thinking - Stress & Time Management - Professionalism in Today's Workforce.		
		Total Instructional hours : 30

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Course Outcomes : Students will be able to	
CO1	Develop professional communication through LSRW skills.
CO2	Apply systematic approach in problem solving skills.
CO3	Utilize leadership skills with ability to work in a team.
CO4	Demonstrate employability skills.
CO5	Analyze & adapt workplace etiquette.

Reference Books	
1.	Meenakshi Raman, ShaliniUpadhyay, 'Soft Skills', Cengage Learning India Pvt. Ltd, Delhi, 2018.
2.	M.S. Rao,'Soft Skills Enhancing Employability', I.K. International Publishing House Pvt. Ltd, New Delhi, 2010.
3.	Sabina Pillai, Agna Fernandez, 'Soft Skills and Employability Skills', Cambridge University Press, 2018.
4.	John Peter.A, 'Self - Development and Professional Excellence', Cengage Learning India Pvt. Ltd, Delhi, 2019.

BoS Chairman

B.E.	B19CEP302 - PROFESSIONAL CERTIFICATE COURSE - I (INTRODUCTION TO MATLAB)	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To familiarize the students in introducing and exploring MATLAB software.
2.	To enable the students on how to approach for solving Engineering problems using simulation tools.
3.	To provide a foundation in use of this software for real time applications.
4.	To prepare the students to use MATLAB in the higher semesters includingtheir project works

Module - I	Introduction TO MATLAB, Programs and Functions	10
Introduction - MATLAB Environment- Quick Start - Built-in Functions - MATLAB Variables, Statements, Elementary Math Functions - Help Facility - Programs, Current Folder - Program Development - Electric Current, Voltage and resistor- Functions - Code Analyzer - Tool Box.		

Module - II	Matrices, Vectors, Scalars and Program Flow Control	10
Matrix Definition - Matrix Arithmetic - Method of Least Squares - Function of a Matrix - Special Matrix Manipulations - Resistive Circuit Analysis - Linear Transformations - Singular Value Decomposition - System of Nonlinear Equations - Relational Operators - Logical Operators - If-Elseif-Else-End - For Loop - While Loop - Method of Steepest Descent - Numerical Integration - Switch-Case-Otherwise.		

Module - III	Graphics	10
Figure - Plots - Edit GUI - Color Map - 3-D Plots - Introduction to Simulink.		

Total Instructional hours : 30

Course Outcomes : Students will be able to	
CO1	Apply programming & simulation for engineering problems.
CO2	Assume the importance of this software for Lab Experimentation.
CO3	Test for basic mathematical, electrical, electronic problems in MATLAB.
CO4	Develop basic electrical circuit in Simulink.
CO5	Demonstrate the programming files with GUI & Simulink.

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Semester - IV

B.E.	B19MAT402 - NUMERICAL METHODS (Common to EEE & AERO)	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	Provide the basic concepts of solving algebraic and transcendental equations.
2.	Introduce the numerical techniques of interpolation in real life situation.
3.	Acquaint the student with understanding of numerical techniques of differentiation and
4.	Integration and apply in engineering and technology disciplines.
5.	Enrich the knowledge insolving ordinarydifferential equations.
6.	Gain practice in solving various typesof partial differential equations.

UNIT - I	ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEMS	12

Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method - Solution of linear system of equations - Gauss elimination method - Pivoting - Gauss Jordan method - Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's methodfor symmetric matrices.

UNIT - II	INTERPOLATION AND APPROXIMATION	12

Interpolation with unequal intervals - Lagrange's interpolation - Newton's divided difference interpolation - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT - III	NUMERICAL DIFFERENTIATION AND INTEGRATION	10

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule - Cubic Spline - Romberg's Method - Two point and three point Gaussian quadrature formulae - Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT - IV	INITIAL VALUE PROBLEMS (ODE)	12

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

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UNIT - V	BOUNDARY VALUE PROBLEMS	14
Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution oftwo dimensional heat equations - Laplace's and Poison's equations (Cartesian co-ordinates only) - One dimensional heat equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Interpret the basic concepts and techniques of solving algebraic and Transcendental equations.
CO2	Apply the numerical techniques of interpolation and error approximations in various intervals.
CO3	Make use of various numerical techniques of differentiation and integration for Engineering problems.
CO4	Relate the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5	Solve the partial and ordinary differential equations with boundary conditions related to engineering problems.

Text Books	
1.	Burden R.L and Faires J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Grewal B.S., and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th edition, New Delhi, 2015.

Reference Books	
1.	Sankara Rao K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2017.
2.	Kandasamy P.,Thilagavathy K., and Gunavathi K., "Numerical Methods", 2nd Edition, S. Chand and Co, Reprint 2012
3.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017.

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B.E.	B19EET401 - CONTROL ENGINEERING	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To understand the use of transfer function models for analysis physical systems and introduce the control system components.
2.	To provide adequate knowledge in the time response of systems and steady state error analysis.
3.	To accord basic knowledge in obtaining the open loop and closed-loop frequency responses of systems.
4.	To introduce stability analysis and design of compensators.
5.	To introduce state variable representation of physical systems.

UNIT - I	SYSTEMS AND REPRESENTATION	12

Basic elements in control systems: - Open and closed loop systems - Mathematical modeling of electrical and mechanical systems - Analogous systems - Transfer function - AC and DC servomotors - Block diagram - reduction techniques - Signal flow graphs - Mason‘s gain formula.

UNIT - II	TIME RESPONSE ANALYSIS	12

Standard test signals - Time response of first order and second order feedback control systems to step input - Time domain specifications - Steady state error - Static error constants - Dynamic error coefficients - Effects of P, PI, PID modes of feedback control.

UNIT - III	FREQUENCY RESPONSE ANALYSIS	12

Frequency domain specifications - peak resonance, resonant frequency, bandwidth and cut-off rate - Correlation between time and frequency responses for second order systems - Polar plot, Bode plot - Gain Margin and Phase Margin.

UNIT - IV	STABILITY AND COMPENSATOR DESIGN	12

Concept of Stability - Necessary conditions for stability - Routh Hurwitz criterion - Nyquist stability criterion of stability - Root locus: concepts of root locus - Construction of root locus - Effect of Lag, lead and lag - lead compensation on frequency response - Design of Lag, lead and lag - lead compensator using bode plots.

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UNIT - V	STATE VARIABLE ANALYSIS	12
Introduction to state space analysis - Physical variable, Phase variable and Canonical variables forms - Transfer function from state space representation - Concepts of controllability and observability.		
Total Instructional hours : 60		

Course Outcomes : Students will be able to	
CO1	Identify the basic components of a control system and Compute the transfer function of the physical systems using appropriate techniques.
CO2	Analyze the response of the system using time domain and frequency domain techniques.
CO3	Identify the stability of the systems using an appropriate method.
CO4	Design compensators for the given system, satisfying the specifications.
CO5	Develop the state space model for a given system and find out the controllability.

Text Books	
1.	M. Gopal, ‘Control Systems, Principles and Design’, 4^{th} Edition, Tata McGraw Hill, New Delhi, 2012.
2.	S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
3.	Norman S. Nise, "Control Systems Engineering", John Wiley and Sons Ltd, 6^{th} Edition, Singapore, 2012.
4.	Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Prentice Hall, 10^{th} Edition, NJ, 2008.

Reference Books	
1.	Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Private Ltd., 4^{th} Edition, New Delhi, 2008.
2.	Nagrath and M.Gopal, "Control Systems Engineering", New Age International Publishers, 6^{th} Edition, New Delhi, 2011.
3.	Benjamin C. Kuo "Automatic Control Systems", Prentice Hall of India, 8^{th} Edition, New Delhi, 2009.

BoS Chairman

B.E.	B19EET402 - INDUCTION AND SYNCHRONOUS MACHINES	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	Construction, principle of operation and performance of induction machines.
2.	Starting and speed control of three-phase induction motors.
3.	Construction, principle of operation and performance of single phase induction motors.
4.	Construction and performance of salient and non - salient type synchronous generators.
5.	Principle of operation and performance of synchronous motor.

UNIT - I	THREE PHASE INDUCTION MOTOR	9

Construction - Types - Principle of Operation - Equivalent Circuit - Phasor Diagram - Power across Air-gap, Torque and Power Output - Torque-Slip Characteristics - No-Load and Blocked Rotor Tests - Circle Diagram - Cogging and Crawling - High Efficiency Induction Motor - Linear Induction Motor (LIM), Testing, Standards, Specifications.

UNIT - II	STARTING, SPEED CONTROL AND BRAKING OF THREE PHASE INDUCTION MOTOR	9

Need for starting - Types of starters - DOL, Rotor resistance, Autotransformer and Star-delta starters - Speed control - Voltage control, Frequency control and pole changing - Cascaded connection-V/f control - Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT - III	SINGLE PHASE INDUCTION MOTORS	9

Constructional details of single phase induction motor - Double field revolving theory and operation -Equivalent circuit - No load and blocked rotor test - Performance analysis - Starting methods of single - phase induction motors - Capacitor-start capacitor run Induction motor - Shaded pole induction motor.

UNIT - IV	ALTERNATORS	9

Construction - Armature Winding - Winding Factors - EMF Equation - Armature Reaction - Voltage Regulation - Predetermination of Regulation by Synchronous Impedance, MMF, and Potier Methods - Power Flow Equations - Parallel Operations - Synchronization and Synchronizing Power - Synchronizing to Infinite Busbar - Performance Analysis of Synchronous Generator using Simulation software.

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UNIT - V	SYNCHRONOUS MOTOR	9
Principle of Operation - Methods of Starting - Phasor Diagrams - Power Flow Equations - Effect of Varying Field Current and Load - V and Inverted V Curves - Synchronous Condenser - Hunting and Suppression Techniques-Performance Analysis of Synchronous Motor using Simulation software.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Identify the performance of 3 - phase Induction motor along with its construction and operation.
CO2	Classify the different types of Starters and explain the different techniques for the Speed control and breaking of an Induction Motor.
CO3	Identify the performance of 1 - phase Induction motors along with construction, operation and its starting methods.
CO4	Develop computer program for the performance of atternators along with its construction, operation, parallel operation of atternators.
CO5	Identify the performance of synchronous motors along with its principle of operation, starting methods and digital computer simulation.

Text Books	
1.	Bimbhra P S, — “Electrical Machinery”, Khanna Publishers, New Delhi, 2011.
2.	D.P. Kothari and I.J. Nagrath, — “Electric Machines”, McGraw Hill Education (India) Private Limited, New Delhi, 2013.
3.	K Murugesh Kumar, “Electrical Machines - II”, Vikas Publishing House, New Delhi, 2010.

Reference Books	
1.	A.E. Fitzgerald, Charles Kingsley Jr., and Stephen D. Umans, — “Electric Machinery”, Tata McGraw-Hill, New Delhi, 2011.
2.	Bhattacharya S.K. — “Electrical Machines”, Tata McGraw-Hill, New Delhi, 2011.

BoS Chairman

B.E.	B19EET403 - GENERATION TRANSMISSION AND DISTRIBUTION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To familiarize with the structure of power system network.
2.	To obtain the equivalent circuits for the transmission lines based on distance and todetermine voltage regulation and efficiency.
3.	To understand the mechanical design of transmission lines.
4.	To analyze the voltage distribution in insulator strings to improve the efficiency.
5.	To study about distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.

UNIT - I	INTRODUCTION FOR GENERATION	9
Introduction - Structure of Electric Power System - Conventional source of electrical energy - basic layout of thermal power generation, hydroelectric power generation and nuclear power plant - Energy, power, efficiency calculations of conventional power plant - Basic layout of sustainable energy resources (solar, wind, biomass, geothermal, tidal) - Different operating voltages of generation, transmission and distribution - advantage of higher operating voltage for AC transmission - Indian energy scenario.		

UNIT - II	TRANSMISSION LINE PARAMETERS	9
Transmission line parameters of single and three phase transmission lines with single and double circuits: resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines.		

UNIT - III	MODELLING AND PERFORMANCE OF TRANSMISSION LINES	9
Performance of short, medium and long transmission line - equivalent circuits and mathematical models - Ferranti effect - surge impedance, attenuation constant, phase constant and surge impedance loading - voltage regulation and transmission efficiency, real and reactive power flow in lines - power circle diagrams - Formation of corona - Effect on the performance.		

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UNIT - IV	INSULATORS, CABLES AND MECHANICAL DESIGN OF LINES	9
Classification of insulators for transmission and distribution purpose - voltage distribution in insulator string and grading - improvement of string efficiency - Underground cables - constructional features of LT and HT cables - capacitance - dielectric stress and grading. Mechanical design of OH lines - Line Supports - Types of towers - Sag and tension calculations - effect of wind and ice.		

UNIT - V	SUBSTATION, DISTRIBUTION SYSTEM AND GROUNDING SYSTEM	9
Types of substations - bus-bar arrangements - substation bus schemes: single bus scheme, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker-and-a-half with two main buses, double bus - bar with bypass isolators - radial and ring-main distributors - Importance of earthing in a substation - Methods of Grounding - Qualitative treatment to neutral grounding and earthing practices in substations - Feeders. Trends in Transmission and Distribution: EHVAC, HVDC and FACTS.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the structure and operations of generation, transmission, distribution Systems.
CO2	Solve the Transmission lines parameters.
CO3	Model and solve the performance characteristics of the given transmission line.
CO4	Illustrate the types and constructional features of cables and insulation.
CO5	Explain the distribution, Substation schemes and grounding system.

Text Books	
1.	S.N. Singh, ‘Electric Power Generation, Transmission and Distribution’, Prentice Hallof India Pvt. Ltd, New Delhi, Second Edition, 2011.
2.	C.L. Wadhwa, ‘Electrical Power Systems’, New Academic Science Ltd, 2009.
3.	Rai G.D., “Non-conventional energy resources”, Khanna publishers, 2014.

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Reference Books	
1.	Arun Ingole, "power transmission and distribution" Pearson Education, 2017
2.	B.R.Gupta, ‘Power System Analysis and Design’ S. Chand, New Delhi, Fifth Edition, 2008.
3.	William.D.Stevenson. Jr., “Elements of Power System Analysis”, McGraw Hill, NewDelhi, 2014.
4.	Nagarath .I.J. & Kothari.D.P., “Modern Power System Analysis”, Tata McGraw Hill Publishing Company, New Delhi, 2014.
5.	G.Ramamurthy, “Handbook of Electrical power Distribution,” Universities Press, 2013.

BoS Chairman

B.E.	B19EET404 - DIGITAL LOGIC CIRCUITS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To study various number systems and Digital logic families.
2.	To simplify the logical expressions using Boolean functions.
3.	To design combinational circuits and Sequential circuits.
4.	To learn about semiconductor memories and PLDs.
5.	To introduce digital simulation for development of application oriented logic circuits.

UNIT - I	REVIEW OF NUMBER SYSTEMS AND LOGIC FAMILIES	9

Number Systems - Decimal, binary, octal and hexadecimal numbers. Binary codes - BCD, Excess - 3, Gray, ASCII codes - Code conversions- Binary to Gray code, Gray code to Binary, Binary to ASCII, ASCII to Binary. Logic gates - Logic gates and their truth table. Logic families - Characteristics - fan-in, fan-out, propagation delay, power dissipation, RTL,DTL,TTL ,Schottky TTL, NMOS, CMOS, ECL - Implementation of 2 input NOR, NAND gates using TTL & CMOS Logic.

UNIT - II	COMBINATIONAL CIRCUITS	9

Boolean Algebra and laws Simplification of Boolean expressions - Introduction to sum of products (SOP) & product of sums (POS) - Logic Minimization using K-map and their realisation using logic gates. Simplification and implementation of combinational logic - multiplexers and de multiplexers - adders, subtractors, BCD arithmetic, CLA, Serial adder, Encoders and Decoders, Code converters, comparators, ALU - elementary ALU design, Q - M method of function realization.

UNIT - III	SEQUENTIAL CIRCUITS	9

Latches and Flip Flops (SR,JK,T,D), State Diagrams, Timing Diagrams and state Tables, Sequential Circuit Design, Moore and Melay Machines, Shift Registers, Synchronous counters (up, down, up-down, mod-N, Ring) - state diagram; state reduction; state assignment - Digital clock. Asynchronous Sequential Logic circuits - characteristics - Racing and Glitches, Asynchronous Counters (up, down) - Transition stability, flow stability - race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits.

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UNIT - IV	SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES	9
Memory organization and operation, expanding memory size, classification and characteristics of memories, RAM (static and dynamic), ROM (EEPROM, FLASH), CAM, CCD. Programmable Logic Devices: PROM - PLA - PAL, Introduction to CPLDs - Study of the architecture of CPLD and Study of the Architecture of FPGA.		

UNIT - V	VHDL	9
Introduction - Code structure - Data types - Introduction to Packages - Subprograms - Operators - RTL Design - combinational circuit - Sequential circuit - Test bench. (Simulation / Tutorial Examples: Adders, Multiplexers & Demultiplexers, flip flops, counters).		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the number systems and digital logic families.
CO2	Solve the logical expressions using Boolean functions.
CO3	Construct the combinational circuits and Sequential circuits.
CO4	Explain semiconductor memories and Programmable Logic Devices.
CO5	Develop digital simulation for logic circuit.

Text Books	
1.	M. M. Mano, 'Digital logic and computer design', Pearson Education, 2016.
2.	S. Salivahanan, 'Digital Circuits and Design', Oxford University Press, 2018.
3.	M. Morris Mano, 'Digital Design with an introduction to the VHDL', PearsonEducation, 2013.
4.	Comer "Digital Logic & State Machine Design, Oxford, 2012.

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Reference Books	
1.	Mandal, “Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
2.	William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 2013.
3.	Thomas L.Floyd, ‘Digital Fundamentals’, 11th edition, Pearson Education, 2015.
4.	Charles H.Roth, Jr, Lizy Lizy Kurian John, ‘Digital System Design using VHDL, Cengage, 2013.
5.	D.P.Kothari,J.S.Dhillon, ‘Digital circuits and Design’,Pearson Education, 2016.
6.	John M.Yarbrough, ‘Digital Logic, Application & Design’, Thomson, 2002.
7.	Douglas L. Perry, ‘VHDL: Programming by Example’, McGraw Hill Edu, 2002.

BoS Chairman

B.E./ B.Tech.	B19MCT302 - INDIAN CONSTITUTION (Common to all Branches)	T	P	TU	C
		3	0	0	NC

Course Objectives	
1.	To understand the constitutional organization of India.
2.	To understand the hierarchy of Union Government of India.
3.	To know the hierarchy and systems of state Governments.
4.	To know the power, role of local administration in Government sectors.
5.	To understand role, function of Election Commission of India.

UNIT - I THE CONSTITUTION - INTRODUCTION

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation

UNIT - II UNION GOVERNMENT

- Structure of the Indian Union
- President - Role and Power
- Prime Minister and Council of Ministers

UNIT - III STATE GOVERNMENT

- Governor - Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

UNIT - IV LOCAL ADMINISTRATION

- District Administration
- Municipal Corporation
- Zila Panchayat

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UNIT - V	ELECTION COMMISSION

- ❍ Role and Functioning
- ❍ Chief Election Commissioner
- ❍ State Election Commission

Total Instructional hours : 30

Course Outcomes : Students will be able to	
CO1	Develop the knowledge on organization of Indian constitution
CO2	Explain the hierarchy organization of Indian Government
CO3	Explain various systems and applications of State Governments
CO4	Illustrate the power and functional systems of local administration
CO5	Summarize the role and administration of Indian Election Commission

Text Books	
1.	Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, New Delhi, 2008.
2.	Fadia, B.L., "The Constitution of India", Sahitya Bhawan, New Edition, 2017.
3.	Basu, D.D., "Introduction to the Constitution of India", Lexis Nexis ; Twenty - Third, 2018.

Suggested Software / Learning Websites	
1.	https://www.constitution.org/cons/india/const.html
2.	http://www.legislative.gov.in/constitution-of-india
3.	https://www.sci.gov.in/constitution
4.	https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/

BoS Chairman

B.E.	B19EEP401- AC MACHINES AND CONTROL SYSTEM LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To understand the importance of Induction Machines.
2.	To understand and analyze EMF, MMF and ZPF methods.
3.	To understand the importance of Synchronous machines and performance.
4.	Develop and understand linear and stability analysis using MATLAB.
5.	To provide knowledge on design of control system.

List of Experiments

Expt. No.	Description of the Experiments
1.	Load test on three phase induction motor
2.	No-load test and blocked rotor test on three phase induction motor
3.	Load test on single phase induction motor
4.	No-load test and blocked rotor test on single phase induction motor
5.	Regulation of three phase alternator by EMF and MMF methods
6.	Regulation of three phase alternator by ZPF methods
7.	Slip test on synchronous machines
8.	Parallel operation of three phase synchronous machines
9.	V and Inverted V curves of Three Phase Synchronous Motor
10.	Study of DC and AC position control system and Synchro - Transmitter - Receiver Characteristics
11.	Design of P, PI and PID controller
12.	Stability analysis of a second order system using MATLAB
	Total Instructional hours : 60

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Course Outcomes : Students will be able to	
CO1	Analyze the load characteristics of Induction motor by direct and indirect method.
CO2	Determine the regulation of alternater by EMF, MMF and ZPF methods and estimate the direct and gudrature axis reactance by slip test.
CO3	Construct V and invested V curves of synchronous motor and identify the conditions for parallel operation of synchronous machine.
CO4	Experiment with P, PI, PIB controllers position control aystems and Synchro-Transmitter.
CO5	Make use of Mat Lab software for digital simulation of second order systems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Name of the Equipment	Quantity required
1.	DC Shuntmotor Coupled With Three Phase Slip Ring Induction Motor	1 Nos
2.	Three Phase Induction Motor With Loading Arrangement	2 Nos
3.	Single Phase Induction Motor With Loading Arrangement	2 Nos
4.	Tachometer Digital Analog	8 Nos
5.	Single Phase Auto Transformer	2 Nos
6.	Three Phase Auto Transformer	2 Nos
7.	Single Phase Resistive Loading Bank	2 Nos
8.	Capacitor Bank	1 Nos
9.	DC Shunt Motor Coupled With Three Phase Alternator	4 Nos
10.	Three Phase Resistive Loading Bank	2 Nos
11.	MATLAB Software	5 Nos
12.	Position Control System Kit	1 Nos
13.	AC Synchro Transmitter And Receiver	1 Nos
14.	PID Controller KIT	1 Nos
15.	Synchronous Induction Motor 3 HP	1 Nos

BoS Chairman

B.E.	B19EEP402 - LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To learn the Basic Digital IC's.
2.	To learn design, testing and characterizing of circuit behavior with digital ICs.
3.	To learn design, testing and characterizing of circuit behavior with analog ICs.
4.	To learn the applications of operational amplifier and Timer.
5.	To learn the digital simulation for development of application oriented logic circuits.

List of Experiments

Expt. No.	Description of the Experiments
1.	Study of Basic Digital IC's. (Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND,JK FF, RS FF, D FF)
2.	Implementation of Boolean Functions, Adder and Subtractor circuits
3.	Design and implementation of Code converters
4.	Design and implementation of Parity generator and parity checker
5.	Design and implementation of Encoders and Decoders
6.	Design and implementation of multiplexer and de-multiplexer
7.	Design and implementation of synchronous counters and Asynchronous Counters
8.	Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's
9.	Study of Astable and monostable multivibrators using NE555 Timer
10.	Application of Op-Amp: Voltage to Current Converter, Current to Voltage Converter and Zero crossing detector
11.	Simulation and verification of Combinational Circuits using software tool
12.	Simulation and verification of sequential Circuits using software tool
	Total Instructional hours : 30

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Course Outcomes : Students will be able to	
CO1	Apply Boolean functions in Digital Logic circuits.
CO2	Construct and Implement combinational circuits.
CO3	Construct and Implement Sequential circuits.
CO4	Build of various applications using Operational Amplifier IC 741 and NE 555 Timer.
CO5	Analyze the combinational and sequential logic circuits using software tools.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity required
1.	Dual (0-30V) variable Power Supply	10
2.	CRO (30MHz)	9
3.	Digital Multimeter	10
4.	Function Generator (1 MHz)	8
5.	IC Tester (Digital)	1
6.	Bread board	10
7.	PC with circuit simulation Software (Lab VIEW / Multisim /HDL)	2
8.	IC 741	10
9.	IC NE555	10
10.	Digital IC types(IC 7432, IC 7408, IC 7400, IC 7404, IC 7402, IC 7486, IC 7410, IC 7476, IC 7474)	Each 10
11.	LED	10
12.	Digital IC Trainer Kit	8
13.	Resistors 1/4 Watt Assorted	20
14.	Capacitor	10
15.	Step-down transformer 230V/12-0-12V	10
16.	Single Strand Wire	2 coil

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B.E.	B19EEA401 - VIRTUAL INSTRUMENTATION LAB - I	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To gain knowledge on Graphical system design.
2.	To understand basic LabVIEW programming and create a virtual instrument (VI).
3.	To understand the modular programming concepts.
4.	To impart knowledge on Loops and Structures.

List of Experiments

Expt. No.	Description of the Experiments	
1.	Introduction to LabVIEW : Mathematical equation implementation	
	a.	Temperature conversion from Celsius to Fahrenheit
	b.	Speed conversion from angular velocity to linear velocity
2.	Implement 4 X 1 MUX using Case Structure	
3.	Simulation of the Water level in the tank using LabVIEW	
4.	Implement Traffic signal using state machine in LabVIEW	
5.	Communicate the data between two loops using local variables, queues & notifiers	
6.	Generate the Sine waveform in LabVIEW & write the same into a TDMS file	
7.	Implement the first order system in LabVIEW and calculate the step signal output	
8.	Measure the square waveform in the analog input and measure the FFT of the signal. Vary the square waveform duty cycle & observe the THD levels	
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Illustrate front panels, block diagrams, icons and connector panes.
CO2	Create user interfaces with charts, graphs and buttons.
CO3	Use the programming structures and data types that exist in LabVIEW.
CO4	Interpret the Concepts of Local variables, Sequential and State Programming.
CO5	Interpret the concept of Case structures, Local variables.

BoS Chairman

B.E / B. Tech	B19CEP401 - CAREER ABILITY COURSE - I	T	P	TU	C
		0	2	0	NC

Sl. No.	Topics	Hours
1.	**NUMBER SYSTEM** Numbers, HCF and LCM of Numbers, Decimal Fractions, Square Roots & Cube Roots, Problems on Numbers, Surds and Indices	6
2.	**SIMPLIFICATION** Addition, Subtraction, Multiplication, Division, Decimal Fractions BODMAS Rule.	6
3.	**ARITHMETIC ABILITY - I** Average, Problems on Ages, percentage, Profit & Loss, Ratio and Proportion, Partnership.	6
4.	**ARITHMETIC ABILITY - II** Chain Rule, Time and Work, Pipes and cisterns, Time and Distance.	6
5.	**ARITHMETIC ABILITY - III** Problems on trains, Boats and Streams, Allegation or Mixture, Simple interest, Compound Interest.	6
	Total Instructional Hours : 30	

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Semester - V

B.E.	B19EET501 - DESIGN OF ELECTRICAL MACHINES	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To know about the Magnetic circuitparameters and thermal rating of various types of electrical machines.
2.	To understand and design of Core, yoke, windings and cooling systems of transformers.
3.	To get knowledge about the design of Armature and field systems for D.C. machines.
4.	To understand the design ofstator and rotor of induction machines and synchronous machines.
5.	To know about the importanceof computer aided design method.

UNIT - I	INTRODUCTION	12

Major considerations in Electrical Machine Design - Electrical Engineering Materials - Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Temperature rise - Standard specifications.

UNIT - II	DESIGN OF TRANSFORMER	12

Construction - KVA output for single and three phase transformers - Overall dimensions - design of yoke, core and winding for core and shell type transformers - Temperature rise in Transformers - Design of Tank and cooling tubes of Transformers-Methods of cooling of Transformers- Computer program: Complete Design of single phase core transformer.

UNIT - III	DESIGN OF DC MACHINES	12

Construction - Output Equations - Main Dimensions - Choice of specific loadings - Design of lap winding and wave winding-Selection of number of poles - Design of Armature - Design of commutator and brushes - design of field - Computer program: Design of Armature main dimensions.

UNIT - IV	DESIGN OF INDUCTION MOTORS	12

Construction - Output equation - Main dimensions - choice of specific loadings - Design of squirrel cage rotor and wound rotor - Circle diagram - Computer program: Design of slip-ring rotor.

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UNIT - V	DESIGN OF SYNCHRONOUS MACHINES	12
Output equations - choice of specific loadings - Design of salient pole machines - Short circuit ratio - Armature design - Estimation of air gap length - Design of rotor - Design of damper winding - Design of field winding - Design of turbo alternators -Computer program: Design of Stator main dimensions.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Illustrate the magnetic circuit parameters and thermal rating of various types of electrical machine.
CO2	Construct the core, yoke, winding and cooling system of transformers.
CO3	Estimate MMF for slots and teeths, apparent flux density, main dimensions and winding details of DC machines.
CO4	Estimate the parameters of AC machines on output equation, stators and rotor of Induction machines.
CO5	Estimate the parameters based on stator and rotors of synchronous machines and analyze their thermal behavior.

Text Books	
1.	M.V. Deshpande 'Design and Testing of Electrical Machines' PHI learning Pvt Lt, 2011.
2.	Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBHPublishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.
3.	A.K.Sawhney. Electrical machine Design, Dhanpat Rai & Sons, 6th Edition, 2006.

Reference Books	
1.	V Rajini, V.S Nagarajan, 'Electrical Machine Design', Pearson, 2017.
2.	K.M. Vishnumurthy 'Computer aided design of electrical machines' B.S. Publications, 2008.
3.	H.M. Rai, Electrical machine design - Sathiya Prakashan Publication, 5th edition 2008.
4.	A. Shanmugasundaram, G. Gangadharan, R. Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.
5.	R.K. Agarwal, Electrical machine design, S.Kataria & Sons, 5th edition 2007.

BoS Chairman

B.E.	B19EET502 - POWER ELECTRONICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To get an overview of different types of power semiconductor devices and their switching.
2.	To understand the operation, characteristics and performance parameters of controlled rectifiers.
3.	To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
4.	To learn thedifferent modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
5.	To understand the operation of AC voltage controller and Cycloconverter various configurations.

UNIT - I	POWER SEMICONDUCTOR DEVICES	9
Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT - Static and Dynamic characteristics - Gate triggering circuit and commutation circuit for SCR - Design of Driver and protection for power MOSFETs, IGBTs and Thyristor- Heat sink calculation.		

UNIT - II	AC TO DC CONVERTERS	9
Single phase and three phase converters in CCM and DCM Operation - Effect of source inductance - performance parameters - Gate Circuit Schemes for Phase Control - Dual converters - Applications: Battery charger, HVDC System.		

UNIT - III	DC TO DC CONVERTERS	9
Step-down and step-up chopper-control strategy - Introduction to types of choppers: A, B, C, D and E - Switched mode regulators: Buck, Boost, Buck - Boost regulator, Introduction to Resonant Converters, Applications: Battery operated vehicles, SMPS.		

UNIT - IV	DC TO AC CONVERTERS	9
Single phase Half bridge inverter - Full bridge inverter - three phase voltage source inverters (both 1200 mode and 1800 mode) - Voltage& harmonic control - PWM Schemes - Current source inverter - Introduction to Space vector pulse width modulation - Multilevel inverter, Applications: Induction heating, UPS.		

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UNIT - V	AC TO AC CONVERTERS	9
Single phase AC switching controllers with R and R-L loads - Three phase AC voltage controllers-Control strategy- Power Factor Control - Multistage sequence control - single phase and three phase cycloconverters - Introduction to Matrix converters, Applications: light dimmer, welding.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Outline the operation, characteristic and turn on methods of different types of power semiconductor devices.
CO2	Explain theoperation of phase controlled Converters and its performance parameters.
CO3	Classify different types of DC-DC converter and switching regulators and explain its operation with control techniques.
CO4	Choose the different modulation techniques for pulse width modulated inverters and to infer the harmonic reduction methods.
CO5	Explain the operation of AC voltage controller and Cycloconverter with various configurations.

Text Books	
1.	M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Fourth Edition, New Delhi, 2014.
2.	P.S. Bimbra "Power Electronics" Khanna Publishers, Fifth Edition, 2012.
3.	M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

Reference Books	
1.	Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2.	L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
3.	Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
4.	S. Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
5.	J.P. Agarwal," Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002

BoS Chairman

B.E.	B19EET503 - INTRODUCTION TO MICROPROCESSOR AND MICROCONTROLLERS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart knowledge on Architecture of 8085 microprocessor and 8051 microcontroller.
2.	To introduce a knowledge on addressing modes and instruction set of 8085 microprocessor and 8051 microcontroller.
3.	To make the students to be familiar with assembly language programs.
4.	To impart knowledge on Architecture, addressing modes and instruction set of PIC16F877 microcontroller.
5.	To impart knowledge on interfacing peripherals with 8051 microcontroller.

UNIT - I	8085 MICROPROCESSOR	9

8085 Microprocessor : Architecture - Functional block diagram - Interrupts - Timing and Control Signals - Machine cycles and timing diagrams, memory interfacing - Instruction formats - Addressing modes - Instruction set - Data transfer, data manipulation & Control instructions - Subroutine instructions - Stack - Simple assembly language programs.

UNIT - II	8051 MICROCONTROLLER	9

8051 Architecture - Pin details- Timing Diagram - Memory - Parallel Ports - Counters / Timers - Interrupts - Serial port - Addressing modes - Instruction set of 8051.

UNIT - III	INTERFACING PERIPHERALS WITH 8051 MICROCONTROLLER	9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8051.Interfacing of LED, Seven Segment Display, LCD display - Keyboard Interfacing - Relay and Sensors Interfacing.

UNIT - IV	8051 MICROCONTROLLER PROGRAMMING & APPLICATIONS	9

Basic Assembly language Programming - Arithmetic operations - Code conversions - Sorting - Look up tables - subroutines - Timer and serial port programming - Keyboard and display interface - Control of Servo motor - Stepper motor control - Washing machine control.

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UNIT - V	PIC16F877 MICROCONTROLLER	9
Architecture - Program and Data memory Organization - Special function registers - Addressing modes, Instruction set.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the Architecture memory organisation, Interrupts, Addressing mode, Instruction set of 8085 Microprocessor.
CO2	Explain the Architecture, Memory Organization, Interrupts, addressing modes and instruction set of 8051 Microcontrollers.
CO3	Explain the interfacing of 8051 with peripheral devices.
CO4	Explain the applications of 8051 Microcontroller.
CO5	Explain the architecture, memory organisation, addressing mode and Instruction set of PIC16F877 Microcontroller.

Text Books	
1.	R.S. Gaonkar, ‘Microprocessor Architecture Programming and Application’, with 8085, Wiley Eastern Ltd., New Delhi, 2013.
2.	Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D Mckinlay "The 8051 Microcontroller and Embedded Systems", Pearson Education India, New Delhi, 2011.
3.	P.S.Manoharan, P.S.Kannan, “Microcontroller based system design”, Scitech Publications Pvt. Ltd., Chennai, 2015.
4.	Sunil Mathur & Jeebananda Panda, “Microprocessor and Microcontrollers”, PHI Learning Pvt. Ltd., 2016.
5.	John B.Peatman, Design with PIC Microcontrollers, Pearson Education, 2002.

Reference Books	
1.	Subrata Ghoshal, - 8051 Microcontroller : Internals, Instructions, Programming and Interfacing, Pearson Education India, New Delhi, 2010.
2.	Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051, McGraw Hill Edu,2013.
3.	Douglas V.Hall, ‘Microprocessor and Interfacing’, McGraw Hill Edu, 2016.

BoS Chairman

B.E.	B19CST511- DATA STRUCTURES AND ALGORITHMS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To learn the features of C
2.	To learn the linear and non-linear data structures
3.	To explore the applications of linear and non-linear data structures
4.	To learn to represent data using graph data structure
5.	To learn the basic sorting and searching algorithms

UNIT - I	C PROGRAMMING BASICS	9

Structure of a C program - compilation and linking processes - Constants, Variables - Data Types - Expressions using operators in C - Managing Input and Output operations - Decision Making and Branching - Looping statements. Arrays - Initialization - Declaration - One dimensional and Two - dimensional arrays. Strings-String operations - String Arrays. Simple programs - sorting - searching - matrix operations.

UNIT - II	FUNCTIONS, POINTERS, STRUCTURES AND UNIONS	9

Functions - Pass by value - Pass by reference - Recursion - Pointers - Definition - Initialization - Pointers arithmetic. Structures and unions - definition - Structure within a structure - Union - Programs using structures and Unions - Storage classes, Pre-processor directives.

UNIT - III	LINEAR DATA STRUCTURES	9

Arrays and its representations - Stacks and Queues - Linked lists - Linked list-based implementation of Stacks and Queues - Evaluation of Expressions - Linked list based polynomial addition.

UNIT - IV	NON-LINEAR DATA STRUCTURES	9

Trees - Binary Trees - Binary tree representation and traversals -Binary Search Trees - Applications of trees. Set representations - Union-Find operations. Graph and its representations - Graph Traversals.

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UNIT - V	SEARCHING AND SORTING ALGORITHMS	9
Linear Search - Binary Search. Bubble Sort, Insertion sort - Merge sort - Quick sort - Hash tables - Overflow handling.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Select appropriate data types and controls structures for solving the given problem.
CO2	Build simple applications using derived and user defined data types.
CO3	Choose appropriate linear data structure for any given data set.
CO4	Apply the non-linear data structure such as tree and graph to solve problems.
CO5	Analyze the various searching, sorting and hashing algorithms

Text Books	
1.	Pradip Dey and Manas Ghosh, - Programming in C, Second Edition, Oxford University Press, 2011.
2.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, - Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

Reference Books	
1.	Mark Allen Weiss, - Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996
2.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, - Data Structures and Algorithms, Pearson Education, 1983.
3.	Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla, - Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
4.	Jean-Paul Tremblay and Paul G. Sorenson, - An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.

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B.E.	B19EEP501 - MICROPROCESSOR AND MICROCONTROLLERS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To give hands on experience in 8085 assembly language programming.
2.	To introduce 8051 microcontroller programming.
3.	To make the students to understand the interface requirements.
4.	To enhance their knowledge on the latest trends and technologies.
5.	To offer programming practices with Simulators / Open source

List of Experiments

Expt. No.	Description of the Experiments	
1.	8/16 bit arithmetic operations using basic 8085 Microprocessor	
	a.	Addition
	b.	Subtraction
	c.	Multiplication
	d.	Division
2.	8 bit arithmetic operations using basic 8051 Microcontroller	
	a.	Addition
	b.	Subtraction
	c.	Multiplication
	d.	Division
3.	Code conversions (BCD to binary and vice-versa, ASCII to binary and vice-versa)	
4.	ADC & DAC interfacing with 8085	
5.	Stepper motor control using 8051 Microcontroller	

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6.	Timer/Counter applications :	
	i.	Square wave generation
	ii.	Frequency measurement
7.	Serial communication (USART)	
8.	Speed control of DC motor	
9.	Traffic light controller	
10.	Programming practices with Simulators/ Emulators/ Open source	
11.	Mini Project development with Processors	
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Develop an ALP to perform simple Arithmetic operations using8085 & 8051.
CO2	Develop an ALP using basic instructions with 8051 microcontroller execution, including conditional jumps, looping and calling subroutines.
CO3	Develop an ALP to Interface 8085 &8051 with several interfacing kits.
CO4	Analyze the difference between simulator and emulator.
CO5	Develop Mini Project with embedded processors.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with power supply	15
2.	8051 Microcontroller Trainer Kit with power supply	15
3.	8251 Interface board	5
4.	8254 Timer counter	5
5.	ADC and DAC Interface Modules	5
6.	DC Motor with Controller	5
7.	Traffic Light Control system	5
8.	Stepper Motor Interface Module	5

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B.E.	B19EEP502 - POWER ELECONICS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To get the knowledge about the different method of generation of triggering pulses.
2.	To learn the characteristics of different types of power electronic devices.
3.	To understand and analyze the operation of controlled rectifiers and AC to AC converters.
4.	To understand and analyze the operation of Dc-Dc converter and inverters.
5.	To provide hands on experience with power electronic converters using simulation software.

List of Experiments

Expt. No.	Description of the Experiments
1.	PWM pulse generation using operational amplifier
2.	Characteristics of SCR and TRIAC
3.	Characteristics of MOSFET and IGBT
4.	AC to DC half / fully controlled converter
5.	Step down and step up MOSFET based choppers
6.	Four quadrant DC chopper
7.	IGBT based single phase PWM inverter
8.	IGBT based three phase PWM inverter
9.	Single phase AC Voltage controller
10.	Single phase Cycloconverter
11.	Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters, AC voltage controllers)
	Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Make use of op-amp to generate the PWM pulses for switching devices.
CO2	Analyze the characteristics various of switching devices.

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CO3	Make use of Power semiconductor devices design and analyze the performance of AC to DC and AC-AC converter with various firing angle delay.
CO4	Make use of Power semiconductor devices design and analyze the performance of DC to DC converter with variable duty cycle.
CO5	Make use of Power semiconductor devices design and analyze the performance of DC to AC converter with various modulation Index.
CO6	Analyze the performance of the given Power electronic circuit using simulation software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
Sl. No.	**Description of Equipment**	**Quantity required**
1.	Device characteristics(for SCR, MOSFET, TRIAC and IGBT kit with built in / discrete power supply and meters)	2 each
2.	SCR based half controlled converter and fully controlled converter along with built-in/separate/firing circuit/module and meter	2 each
3.	MOSFET based step up and step down choppers (Built in/ Discrete)	2
4.	IGBT based single phase PWM inverter module/Discrete Component	2
5.	IGBT based Three phase PWM inverter module/Discrete Component	2
6.	Four quadrant DC chopper module	1
7.	SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load	2
8.	Cyclo converter kit with firing module	2
9.	Dual regulated DC power supply with common ground	3
10.	Cathode Ray Oscilloscope	10
11.	Isolation Transformer	5
12.	Multimeter	5
13.	LCR meter	3
14.	Rheostats of various ranges	5
15.	Work tables	10
16.	DC and AC meters of required ranges	20
17.	Simulation software	05 license

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B.E.	B19EEA501 - VIRTUAL INSTRUMENTATION LAB - II	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To gain knowledge on I/O functions available in Lab VIEW.
2.	To understand the interfacing concepts.
3.	To understand the communication between parallel loops.
4.	To impart knowledge on DAQ.

List of Experiments

Expt. No.	Description of the Experiments
1.	Measure the Analog input signal and simulate the passive filter in LabVIEW. Implement the passive filter in the bread board and measure the filter output signal using analog input
2.	Measure the audio signal using myDAQ hardware and implement the digital filter (IIR & FIR) in LabVIEW
3.	Generate the square wave in the analog output and develop the simple buck converter using bread board
4.	DC Motor speed control using myDAQ hardware
5.	Distance/ Displacement measurement using IR sensor & myDAQ
6.	Implement the object counter using Proximity sensor & myDAQ
7.	Speed measurement using Proximity sensor & myDAQ hardware
8.	Implement the speed control of the DC motor using LabVIEW
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Make use of I/O functions available in LabVIEW.
CO2	Make use of DAQ device to interface with LabVIEW programming.
CO3	Measure the speed and displacement with the help of sensors & myDAQ.
CO4	Make use of LabVIEW software to implement digital filter.
CO5	Make use of myDAQ hardware to control the speed of DC motor.

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B.E. / B. Tech	B19CEP501 - CAREER ABILITY COURSE- II	T	P	TU	C
		0	2	0	NC

Sl. No.	Topics	Hours
1.	**GENERAL MENTAL ABILITY - I** Analogy, Classification, Series Completion, Coding and Decoding, Blood Relations.	6
2.	**GENERAL MENTAL ABILITY - II** Direction Sense Test, Logical Venn Diagram, Data Sufficiency, Assertion and Reason.	6
3.	**NON VERBAL REASONING - I** Mirror Images, Water Images, Embedded Figures, Paper folding and paper cutting, Cubes and Dice.	6
4.	**NON VERBAL REASONING - II** Completion of incomplete pattern, Dot Situation, Construction of Squares and Triangles.	6
5.	**DATA INTERPRETATION** Tabulation, Bar Graphs, Pie Chart, Line Graphs	6
		Total Instructional Hours : 30

BoS Chairman

Professional Elective - I

B.E.	B19EEE501 - PLC AND SCADA	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To provide fundamental knowledge about the PLC networks.
2.	To give an introductory knowledge about PLC and the programming languages.
3.	To understand what is meant by SCADA and itsfunctions.
4.	To know SCADA architecture and communication.
5.	To get an insight into itsapplication.

UNIT - I	INTRODUCTION TO PLC	9

Evolution of PLCs - controller and hardware - PLC Architecture - PLC sizes andits application - PLC Vs. Computer - PLC Input & Outputmodules, central processing unit, CPUs & Programmer/monitors, Solid state memory, theprocessor, Input modules (Interfaces), Power supplies, PLC advantages & disadvantages - Selection criteria for PLC.

UNIT - II	COMMUNICATION AND PROGRAMMING IN PLC	9

PLC Programming - Ladder logic , Functional block programming, sequentialfunction chat, Instruction list, Communication networks for PLC - connecting PLCto computer - Ladder program for simple on-off applications - Ladder program for Timing and countingapplications.

UNIT - III	INTRODUCTION TO SCADA	9

Data acquisition systems, Evolution of SCADA - Monitoring and supervisory functions, SCADA applications in UtilityAutomation - Communication technologies.

UNIT - IV	ARCHITECTURE AND COMMUNICATION	9

SCADAArchitecture : Various SCADAarchitectures, advantages anddisadvantages of each system - single unified standard architecture - IEC 61850 - SCADA Communication: various industrial communication technologies - wired and wireless methods and fiber optics. open standardcommunicationprotocols.

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UNIT - V	APPLICATIONS	9
Utility applications - Transmission andDistribution sector-Operations, monitoring, analysis and improvement. Industries - oil, gas and water - Case studies, Implementation, Simulation Exercises.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Interpretthe PLC networks.
CO2	Design and execute ladder logic program for any industrial system.
CO3	Explain the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications.
CO4	Apply the acquired knowledge about SCADA architecture, communication and IEC61850.
CO5	Interpretthe SCADA applications in transmission and distribution sector, Industries.

Text Books	
1.	Frank D Petrezeulla, "Programmable Controllers", 4^{th} edition,McGraw Hill, 2010.
2.	Webb & Reis, “Programmable logic Controllers”, (Prentice Hall), 2003.
3.	Stuart A. Boyer: “SCADA-Supervisory Control and Data Acquisition”, Instrument Society of America Publications, USA, 2004.

Reference Books	
1.	Hughes T, "Programmable Logic Controllers", ISA Press, 2000.
2.	Gordon Clarke, Deon Reynders: “Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems”, Newnes Publications, Oxford, UK, 2004.
3.	David Bailey, Edwin Wright, “Practical SCADA for industry”, Newnes, 2003.

BoS Chairman

B.E.	B19EEE502 - COMMUNICATION ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce different methods of analog communication and their significance.
2.	To introduce Digital Communication methods for high bit rate transmission.
3.	To introduce the concepts of source and line coding techniques forenhancing ratingof transmission of minimizing the errors intransmission.
4.	To introduce MAC used in communication systems for enhancing the number of users.
5.	To introduce various media for digital communication.

UNIT - I	ANALOG COMMUNICATION	9

AM - Frequency spectrum - vector representation - power relations generation of AM - DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM - frequency spectrum - power relations: NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency.

UNIT - II	DIGITAL COMMUNICATION	9

Pulse modulations - concepts of sampling and sampling theorems, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems - ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT - III	SOURCE CODES, LINE CODES & ERROR CONTROL	9

Distribution Management System (DMS) - Volt / VAR control - Fault Detection, Isolation and Service Restoration, Network Reconfiguration, Outage management System, Customer Information System, Geographical Information System, Effect of Plug in Hybrid Electric Vehicles. (Qualitativeonly).

UNIT - IV	MULTIPLE ACCESS TECHNIQUES	9

SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits).

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UNIT - V	SATELLITE, OPTICAL FIBER - POWER LINE, SCADA	9
Orbits : types of satellites : frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite - Intelsat and Insat: fibers - types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Ability to understand and analyse linear circuits.
CO2	Ability to understand and analyse digital electroniccircuits.
CO3	Interpretthe source codes, line codes & error control.
CO4	Explain the advantages of FDMA, TDMA, CDMA, SDMA application in wire and wireless. communication.
CO5	Explain the satellite, optical fiber,Powerline and SCADA.

Text Books	
1.	Taub & Schiling "Principles of Communication Systems" Tata McGraw Hill2007.
2.	J.Das "Principles of Digital Communication" New Age International,1986.

Reference Books	
1.	Kennedy and Davis "Electronic Communication Systems" Tata McGraw hill, 4th Edition,1993.
2.	Sklar "Digital Communication Fundamentals and Applications" Pearson Education, 2001..
3.	Bary le, Memuschmidt, Digital Communication, Kluwer Publication,2004.
4.	B.P.Lathi "Modern Digital and Analog Communication Systems" Oxford University Press,1998.

BoS Chairman

B.E.	B19EEE503 - DIGITAL SIGNAL PROCESSING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To classify signals and systems & their mathematical representation.
2.	To analyse the discrete time systems.
3.	To study various transformation techniques & their computation.
4.	To study about filters and their design for digital implementation.
5.	To study about a programmable digital signal processor & quantization effects.

UNIT - I	INTRODUCTION	9

Classification of signals: continuous and discrete, energy and power, even and odd, periodic and aperiodic, deterministic and random- mathematical representation of signals; Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT - II	DISCRETE TIME SYSTEM ANALYSIS	9

Z-transform and its properties, Inverse z-transforms; difference equation - Solution by z-transform-Convolution.

UNIT - III	DISCRETE FOURIER TRANSFORM & COMPUTATION	9

Introduction to Fourier Transform - DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm - DIT & DIF - FFT using radix 2 - Butterfly structure.

UNIT - IV	DESIGN OF DIGITAL FILTERS	9

FIR & IIR filter realization structures- FIR design: Windowing Techniques - IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping.

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UNIT - V	DIGITAL SIGNAL PROCESSORS	9
Introduction - Architecture- Features - Addressing Formats - Functional modes - Introduction to Commercial Processors.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Classify various types of discrete time signals and discrete time systems.
CO2	Apply Z-transform, Fourier transforms for stability and frequency analysis.
CO3	Apply FFT algorithm to compute DFT, Fourier transform to compute frequency response.
CO4	Apply Butterworth and Chebyshev approximations for IIR filter design and windowing techniques for FIR filter design.
CO5	Explain the architecture, addressing formats of DSP processors and quantization effects.

Text Books	
1.	S.K. Mitra, 'Digital Signal Processing - A Computer Based Approach', McGraw Hill Edu, 2013.
2.	Lonnie C.Ludeman ,"Fundamentals of Digital Signal Processing", Wiley, 2013.
3.	J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.

Reference Books	
1.	Sen M.kuo, woonseng s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson, 2013.
2.	P.Ramesh Babu - Digital Signal Processing, Scitech Publications of India, 2012.
3.	B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010.
4.	Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete - Time Signal Processing', Pearson Education, New Delhi, 2003.
5.	B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.

BoS Chairman

B.E.	B19EEE504 - IoT FOR ELECTRICAL ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of IoT.
2.	To acquire knowledge on components of IoT.
3.	To learn about architecture and protocols of IoT.
4.	To impart knowledge on Energy Management System (EMS).
5.	To gain knowledge on applications of IoT.

UNIT - I	INTRODUCTION	9

Internet of Things Promises - Definition - Scope - Overview of the Architecture of Internet of Thing - Overview of the top - level components: the device, gateway and cloud - IoT enabling technologies. Sensors for IoT Applications - Structure of IoT- IoT Map Device.

UNIT - II	IOT COMPONENTS	9

Device platforms: Raspberry Pi - Arduino controller - Overview of Device platforms and interfacing - USB - GPIO - Inter-Integrated Circuit serial bus Serial Peripheral Interface Bus, Universal Asynchronous Receiver / Transmitter (UART) -Sensors: Temperature and Humidity, Moisture, light, Voltage, Current, IR, PIR and Hall sensors.

UNIT - III	ARCHITECTURE AND PROTOCOLS FOR IOT	9

Protocol Standardization for IoT - Efforts - M2M and WSNProtocols - SCADA and RFIDProtocols - Issues with IoT Standardization - Unified Data Standards - Protocols - IEEE802.15.4 - BACNet Protocol - IoT Open source architecture - OIC Architecture &Design principles - IoT Devices and deployment models.

UNIT - IV	ENERGY MANAGEMENT SYSTEM	9

Energy Management System (EMS) - Smart substations - Substation Automation - Feeder Automation, SCADA - Remote Terminal Unit - Intelligent Electronic Devices - Protocols, Phasor Measurement Unit - Wide area monitoring protection and control, Smart integration of energy resources - Renewable, intermittent power sources - Energy Storage - **Batteries - performance, charging and discharging and safety issues.**

BoS Chairman

UNIT - V	APPLICATIONS OF IOT	9
Case Study: Advanced metering infrastructure (AMI) - remote control operation of energy consuming devices - virtual power plants. Smart Grid &IoT, Commercial building automation using IoT - Automation in Industrial aspect of IoT.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Interpret the fundamentals of IoT,
CO2	Interpret the different IoT components.
CO3	Summarize various architecture and protocols of IoT.
CO4	Interpret about Energy Management System (EMS).
CO5	Infer the applications of IoT in automation of power industry.

Text Books	
1.	Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015.
2.	N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.
3.	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, ‘Smart Grid: Technology and Applications’, Wiley, 2012.
4.	R. M. Dell, D.A.J. Rand, ‘Understanding Batteries’, RSC Publications, 2001.

Reference Books	
1.	Stuart Borlase ‘Smart Grid: Infrastructure, Technology and Solutions’, CRC Press 2012.
2.	Mini S. Thomas, John D McDonald, ‘Power System SCADA and Smart Grids’, CRC Press, 2015.
3.	Kenneth C.Budka, Jayant G. Deshpande, Marina Thottan, ‘Communication Networks for Smart Grids’, Springer, 2014.
4.	Tetsuya Osaka, Madhav Datta, ‘Energy Storage Systems in Electronics’, Gordon and Breach Science Publishers, 2000.

BoS Chairman

B.E.	B19EEE505 - SPECIAL ELECTRICAL MACHINES	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To study the construction, principle of operation, control and performance of stepping motors.
2.	To acquire the knowledge on construction, principle of operation, control and performance of synchronous reluctance motors & switched reluctance motors.
3.	To impart the knowledge on construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
4.	To study the construction, principle of operation, control and performance of permanent magnet synchronous motors.
5.	To acquire the knowledge on construction, principle of operation and performance of other special Machines.

UNIT - I	STEPPER MOTORS	9
Constructional features - Principle of operation - Types - Torque predictions - Modes of excitations - Characteristics - Drive circuits - Closed loop control- Microprocessor control - Concept of lead angle - Applications.		

UNIT - II	SPECIAL RELUCTANCE MACHINES	9
Constructional features - Principle of operation, Characteristics and torque equation of Synchronous Reluctance Motor (SyRM) and Switched Reluctance Motor (SRM) - Power controllers - Control of SRM drive- Sensor less operation of SRM-Applications.		

UNIT - III	PERMANENT MAGNET BRUSHLESS D.C. MOTORS	9
Fundamentals of Permanent Magnets - Types - Principle of operation - Magnetic circuit analysis - EMF and Torque equations - Power Converter Circuits and their controllers - Characteristics and control- Applications.		

UNIT - IV	PERMANENT MAGNET SYNCHRONOUS MOTORS	9
Constructional features -Principle of operation - EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers - Performance characteristics - Digital controllers - Applications.		

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UNIT - V	OTHER SPECIAL MACHINES	9
Constructional features, Principle of operation and Characteristics of Linear DC motors - Linear induction motor - Linear synchronous motors - Linear switched reluctance motors - Hysteresis Motor - Servo motor - Applications.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Illustrate the basic construction and operating principle of Stepper motor, Synchronous Reluctance Motor, SRM, PMSM, PMBLDC Motor and other special machines.
CO2	Explain the motor characteristics, power input and torque developed for Stepper motor, Synchronous Reluctance Motor, SRM, PMSM and PMBLDC Motor.
CO3	Develop the control schemes and drive systems for Stepper motors, SRM, PMSM and PMBLDC Motor.
CO4	Select the suitable special purpose motor for the specific application.
CO5	Make use of the Microprocessor/ DSP based control of Stepper motors, SRM, PMSM and PMBLDC Motor.

Text Books	
1.	E.G. Janardanan, “Special electrical machines”, PHI learning Private Limited, Delhi, 2014.
2.	Kenjo T, “Stepping Motors and their Microprocessor Controls”, Clarendon Press London, 2003.
3.	Chang-liang, X., "Permanent Magnet Brushless DC Motor Drives and Controls", Jun 2012.
4.	Ion Boldea, “Linear Electric Machines, Drives, and MAGLEVs Handbook”, CRC Press, London, 2013.

Reference Books	
1.	K. Venkataratnam, “Special Electrical Machines”, University Press, India, 2009.
2.	J.R. Hendershot, Timothy John Eastham Miller, “Design of Brushless Permanent-magnet Machines”, Motor Design Books, 2010.
3.	Miller, T.J.E., “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, 1989.
4.	R.Krishnan, “Permanent Magnet Synchronous and Brushless DC Motor Drives”, Prentice Hall of India,2009.

BoS Chairman

Open Elective - I

B.E. / B.TECH	B19AEO501- BASICS OF FLIGHT MECHANICS (Common to all Except AERO)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understands of basic concepts like lift, drag, pressure distribution and airfoil characteristics
2.	To understand the effect of weight and height, range and endurance of the aircraft.
3.	To know about the different aerobatics and maneuvers performance in the aircraft.
4.	To get introduce to the basic concepts of shock waves, vortex formation and its effects on the aircraft.
5.	To understand the nature of supersonic flow, C-D nozzle expansion and Flight at hypersonic speeds.

UNIT - I	SUBSONIC SPEED AERO FOILS	9

Introduction to Lifting Surfaces - Lift and drag- Airflow and pressure over Airfoil - Chord line and angle of attack - Pressure distribution - Airfoil characteristics - Camber - Design and nomenclature of airfoil sections.

UNIT - II	LEVELING OF FLIGHT	9

Forces Acting on the Aircraft - Balancing the four forces- Loads on tail plane - Effects of downwash - Tail load determination - Relation between air speed and angle of attack - Effect of Weight and Height - Flying for maximum Range and Endurance.

UNIT - III	MANEUVERS	9

Introduction to Degrees of freedom - Diving - Turning - Angles of bank - Turning Problems - Controls on Steep Banks - Aerobatics - Loops, Spins, Rolls, Sideslips and Nose - Dives - Inverted maneuvers.

UNIT - IV	TRANSONIC FLIGHTS	9

Speed of Sound - Compressibility and Incompressibility - Shock waves - Effects of shock waves - Mach Number - Critical Mach Number - Drag rise in the Transonic Region - Drag and Power Required - Behavior of airplane at shock stall - Shock - wave patterns - Pressure distribution - Slimness and Sweep Back - Area rule - Vortex generators.

BoS Chairman

UNIT - V	SUPERSONIC FLIGHTS	9
Introduction to Supersonic flow - Supersonic flow over an aero foil - Convergent divergent nozzle Expanding - contracting duct - Supersonic wing shapes - Supersonic Wing and body shapes - Kinetic heating - Flight at hypersonic speeds.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the Characteristics, Design and Nomenclature of Airfoil Sections. (K2)
CO2	Identify the Forces Acting on the Aircraft and Its Effects to make the Aircraft Flying for Maximum Range and Endurance. (K3)
CO3	Illustrate the different types of Aircraft maneuvering during flight. (K2)
CO4	Outline the effect of shock waves, critical Mach number during transonic flights. (K2)
CO5	Identify the supersonic flow over an Aero foil and able to examine its effects. (K3)

Text Books	
1.	A.C. Kermode cbe, Ma, Ceng, Fraes, “Mechanics of flight s” revised by R H. barnard phd, Ceng, Fraes and D. R. Philpott Phd, Ceng, Mraes, Maiaa, 11th edition.

Reference Books	
1.	Hull DG. “Fundamentals of airplane flight mechanics”. Berlin: Springer; 2007 Feb 5.
2.	Cook MV. “Flight dynamics principles: a linear systems approach to aircraft stability and control”. Butterworth-Heinemann; 2012 Oct 3.
3.	Miele A. “Flight mechanics: theory of flight paths”. Courier Dover Publications; 2016 Mar 15.
4.	Kermode AC. “Mechanics of flight”. Longman Scientific & Technical”; 1987.
5.	Von Mises R. “Theory of flight. Courier Corporation”; 1959.

BoS Chairman

B.E. / B.TECH	B19AG0501 - ENVIRONMENT AND AGRICULTURE (Common to all Except AGRI)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the importance of land, water and social structure in agriculture.
2.	To remember the impacts of mechanization, irrigation and urbanization in agriculture.
3.	To know the ecological issues, climate change, environmental policies and sustainable agriculture.
4.	To learn about the Ecological diversity in agricultural applications.
5.	To understand the emerging issues in environment and agriculture.

UNIT - I	ENVIRONMENTAL CONCERNS	8

Environmental basis for agriculture and food - Land use and landscape changes - Water quality issues - Changing social structure and economic focus - Globalization and its impacts - Agro ecosystems.

UNIT - II	ENVIRONMENTAL IMPACTS	9

Irrigation development and watersheds - mechanized agriculture and soil cover impacts - Erosion and problems of deposition in irrigation systems - Agricultural drainage and downstream impacts - Agriculture versus urban impacts.

UNIT - III	CLIMATE CHANGE	8

Global warming and changing environment - Ecosystem changes - Changing blue-green- grey water cycles - Water scarcity and water shortages - Desertification.

UNIT - IV	ECOLOGICAL DIVERSITY AND AGRICULTURE	10

Ecological diversity, wild life and agriculture - GM crops and their impacts on the environment - Insets and agriculture - Pollination crisis - Ecological farming principles - Forest fragmentation and agriculture - Agricultural biotechnology concerns.

UNIT - V	EMERGING ISSUES	10

Global environmental governance - alternate culture systems - Mega farms and vertical farms - Virtual water trade and its impacts on local environment - Agricultural Biodiversity - Agricultural environment policies and its impacts - Sustainable agriculture.

Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Explain the environmental concerns and impacts in agriculture
CO2	Outline about the interventions like mechanization, watershed development and irrigation in agriculture
CO3	Summarize about the climate change and its issue in agriculture
CO4	Illustrate a capacity building on the focus areas for ecological farming and agriculture biotechnology issues
CO5	Explain the agriculture environmental policies for sustainable agriculture

Text Books	
1.	M.Lakshmi Narasaiah, “Environment and Agriculture”, Discovery Pub. House, 2006.
2.	Arvind Kumar, “Environment and Agriculture”, ABH Publications, New Delhi, 2005.

Reference Books	
1.	T.C. Byerly, “Environment and Agriculture”, United States. Dept. of Agriculture. Economic Research Service, 2006.
2.	Robert D. Havener, Steven A. Breth, “Environment and agriculture: rethinking development issues for the 21st century: proceedings of a symposium”, Winrock International Institute for Agricultural Development, 1994.
3.	“Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium”, Bangkok, Thailand. 1989.
4.	https://nptel.ac.in/courses/126/105/126105014/

BoS Chairman

B.E. / B.TECH	B19BMO501 - INTRODUCTION TO MEDICAL PHYSICS (Common to all Except BME)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To outline the effects of non ionizing radiation and its application.
2.	To summarize the principles of radioactive nuclides.
3.	To explain the interaction of radiation with matter.
4.	To illustrate the radiation detectors.
5.	To explain the radiation quantities.

UNIT - I	NON IONIZING RADIATION AND ITS MEDICAL APPLICATION	9

Overview of non-ionizing radiation effects - Low Frequency Effects - Higher frequency effects. Thermography - Application. Ultrasound Transducer - Interaction of Ultrasound with matter; Cavitations, Conditions for reflection, Transmission - Scanning systems - Artefacts - Ultrasound Doppler - Double Doppler shift Clinical Applications.

UNIT - II	PRINCIPLES OF RADIOACTIVE NUCLIDES	9

Radioactive Decay - Spontaneous Emission - Isometric Transition - Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology ,Decay series, Production of radionuclides - Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, radionuclide Generator-Milking process (Technetiumgenerator).

UNIT - III	INTERACTION OF RADIATION WITH MATTER	9

Interaction of charged particles with matter - Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter - Photoelectric effect, Compton Scattering, Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance.

UNIT - IV	PRINCIPLES OF RADIATION DETECTION AND DOSIMETERS	9

Principles of radiation detection, Properties of dosimeters, Theory of gas filled detectors, Ionization Chamber, Proportional chamber, G.M. Counter, Film dosimetry, luminescence dosimetry, scintillation detectors, Radiation detection instruments, Area survey meters, Personal Radiation monitoring device, Film badge, TLD, OSLD.

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UNIT - V	BASIC RADIATION QUANTITIES	9
Introduction - exposure - Inverse square law - KERMA - Kerma and absorbed dose - stopping power - relationship between the dosimetric quantities - Bremsstrahlung radiation, Bragg"s curve - concept of LD 50 - Stochastic and Non-stochastic effects, Different radiation Unit, Roentgen, gray, Sievert.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Recall the effect of non ionising radiation in human body and applications in the field of medicine
CO2	Interpret radioactive decay and production of radio nuclides
CO3	Discuss the interaction of radiation with matter
CO4	Illustrate the measurement of ionizing radiation
CO5	Summarize about the radiation quantities

Text Books	
1.	John. R Cameron, James G Skofronick, "Medical Physics", John-Wiley & Sons, 1978.
2.	Muhammad Maqbool, "An Introduction to Medical Physics", Springer International Publishing AG 2017.

Reference Books	
1.	P.Uma Devi, A.Nagarathnam, BS Satish Rao, "Introduction to Radiation Biology", B.I Chur Chill Livingstone Pvt. Ltd, 2000.
2.	By B.H Brown, R.H Smallwood, D.C. Barber, P.V Lawford, D.R Hose J.P.Woodcock, "Medical Physics and Biomedical Engineering", CRC Press,1998.
3.	Hylton B.Meire and Pat Farrant, "Basic Ultrasound", John Wiley & Sons, 1995.

BoS Chairman

B.E. / B.TECH	B19BTO501 - FOOD PROCESSING AND PRESERVATION (Common to all Except BT)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the students acquire the basics of food processing.
2.	To able to understand the food preservation techniques.
3.	To be able to understand the significance of food processing.
4.	To familiarize with the recent methods of processing of foods
5.	To understand the principles of food preservation.

UNIT - I	FOOD PROCESSING	9

Principles, importance, food processing methods: pasteurization (definition, time-temperature combination and equipments) sterilization (definition, time-temperature combination and equipments), blanching (definition, time-temperature combination and equipments, adequacy in blanching), canning (definition, time-temperature combination and equipments), packaging (Introduction, Metal Containers, Glass Containers, Rigid Plastic Containers, Retortable Pouches).

UNIT - II	FOOD FREEZING AND DRYING	9

Freezing : Introduction, freezing point and freezing rate, freezing methods: Air freezing, plate freezing, liquid immersion freezing and cryogenic freezing, Freezer selection, Advantages and disadvantages of freezing.

Drying : Definition, free and bound moisture, concept of water activity, factors affecting drying, Drying methods and equipments: sun/solar drying, Cabinet drying, tunnel dryer, spray dryer, freeze dryer, fluidized bed dryer, Nutritional, physico-chemical changes during drying.

UNIT - III	PROCESSING OF FOOD PRODUCTS	9

Evaporation - Definition, types of evaporator (single effect, double effect and multiple effect evaporator); Freeze concentration - General principles and applications, basic elements, ice crystal nucleation, growth and crystallization, separation techniques (filtration and wash column).

UNIT - IV	MEMBRANE TECHNOLOGIES IN FOOD PROCESSING	9

General principles and advantages, dead end and cross flow, Classification of membrane system: Reverse Osmosis, Nanofiltration, Ultra Filtration, Micro Filtration, Electodialysis and Pervaporation; Membrane technology comparison chart, Membrane application in the food industries and industrial effluent treatments; Membrane performance, and Limitation of membrane processes.

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UNIT - V	FOOD PRESERVATION	9
Introduction and principles. Traditional methods of preservation; Types of food based on its perishability; Importance of food preservation, Wastage of processed foods; Shelf life of food products. Advantages of food preservation		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the different methods applied in the processing of foods
CO2	Understand the significance of food processing and the role of food and beverage industries in the supply of foods
CO3	Acquire knowledge on the changes occurring in the food during processing and storage
CO4	Explain the food preservation and various food processing techniques
CO5	Understand effective food preservation techniques

Text Books	
1.	Ramaswamy H. and Marcotte M, “Food Processing: Principles and Applications”, by Taylor & Francis, 2005.
2.	Norman N Potter and Joseph H. Hotchkiss, “Food Science”, 5th Edition, CBS Publishers and Distributors, 1996.
3.	Barbosa-Canovas.,“Novel Food Processing Technologies”, Tapia & Cano CRC Press, 2004.
4.	Gould GW, “New Methods of Food Preservation”, Springer Science & Business Media. 2012.
5.	Rahman MS, “Food Preservation”, In: Handbook of Food Preservation, 2nd Edition, (pp. 14-29), CRC press, 1999.
6.	Subbulakshmi G. and A.S. Udipi, “Food Processing and Preservation”, New Age Publications, 2006.

Reference Books	
1.	Manay S. and M.S. Swamy, “Foods: Facts and Principles”, 4th Ed. New Age Publishers, 2004.
2.	Deman J.M., “Principles of Food Chemistry”, 2nd Ed., Van Nostrand Reinhold, NY., 1990.

BoS Chairman

B.E. / B.TECH	B19CSO504 - FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEM (Common to all Except CSE, AI&DS, CSBS)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts of database management systems.
2.	To acquire basic knowledge about database models and its design.
3.	To reveal the role and functionalities of database in business community.
4.	To learn about the Structured Query Language (SQL)
5.	To learn the client / server relation.

UNIT - I	INTRODUCTION	9

Database Types and Systems - An Overview - Meaning, Definition - Components - Objectives - Advantages and Disadvantages - Evolution.

UNIT - II	MODELS	9

DBMS Architecture - Associations - Relationship - Generalization - Classifications - Conceptual Data Modeling - File Organization.

UNIT - III	DATABASE DESIGN	9

Relational Data Model - ER Diagram - Data Dictionary - Normalization - Boyce Code Normal Form - Integrity - Relational Database Languages - Database Administration.

UNIT - IV	UNDERSTANDING SQL	9

SQL Data Definition and Data Types - SQL - Specifying Constraints - Key and Referential Integrity Constraints - Basic Retrieval Queries in SQL - Joins - Sub queries - Nested subquery.

UNIT - V	OPERATIONS AND MANAGEMENT	9

Client/Server and Databases - Data Warehousing - Query Processing - Heterogeneous and Homogeneous - Controls.

Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Understand the basics of database management systems.
CO2	Acquire basic knowledge about database and its design with models.
CO3	Translate ER model to Relational model to perform database design effectively.
CO4	Understand the SQL for DB creation and updation.
CO5	Design client / server relation.

Text Books	
1.	Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017.

Reference Books	
1.	Abraham Silberschatz, Henry F Korth and Sudarshan S, "Database System Concepts", Sixth Edition, McGraw-Hill, 2011.
2.	Martin Gruber," Understanding SQL", Sybex Inc,1990 (4^{th} unit 50%)
3.	C.J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
4.	Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill College Publications, 2015.

BoS Chairman

B.E. / B.TECH	B19ECO501 - LOGIC AND DISTRIBUTED CONTROL SYSTEMS (Common to all Except ECE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To give an introductory knowledge on Programmable Logic Controller (PLC) and their programming languages
2.	To give adequate knowledge about applications of PLC
3.	To give basic knowledge about Computer Controlled Systems
4.	To give basic knowledge on the architecture and local control unit of Distributed Control System (DCS)
5.	To give adequate information with respect to interfaces used in DCS

UNIT - I	PROGRAMMABLE LOGIC CONTROLLER	9

Evolution of PLCs - Components of PLC - Architecture of PLC - Discrete and analog I/O modules - Programming languages - Ladder diagram - Function block diagram (FBD) - Programming timers and counters.

UNIT - II	APPLICATIONS OF PLC	9

Instructions in PLC - Program control instructions, math instructions, data manipulation Instructions, sequencer and shift register instructions - Case studies in PLC.

UNIT - III	COMPUTER CONTROLLED SYSTEMS	9

Basic building blocks of computer controlled systems - Data acquisition system - Supervisory control - Direct digital control- SCADA - Hardware and software, Remote terminal units, Master Station and Communication architectures.

UNIT - IV	DISTRIBUTED CONTROL SYSTEM	9

DCS - Various Architectures - Comparison - Local control unit - Process interfacing issues - Communication facilities.

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UNIT - V	INTERFACES IN DCS	9
Operator interfaces - Low level and high level operator interfaces - Displays - Engineering interfaces - Low level and high level engineering interfaces - Factors to be considered in selecting DCS - Case studies in DCS.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Infer the PLC
CO2	Apply PLC in various applications
CO3	Infer the concepts of Computer Controlled Systems
CO4	Construct knowledge about various architectures of DCS
CO5	Analyze the various interfaces in DCS

Text Books	
1.	F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010.
2.	Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986.
3.	D. Popovic and V.P.Bhatkar, “Distributed computer control for industrial Automation” Marcel Dekker, Inc., Newyork ,1990.

Reference Books	
1.	T.A. Hughes, “Programmable Controllers”, Fourth edition, ISA press, 2005.
2.	Krishna Kant, “Computer Based Industrial Control”, Second edition, Prentice Hall of India, New Delhi, 2010.
3.	John W. Webb and Ronald A. Reis, “Programmable Logic Controllers”, Fifth edition, Prentice Hall of India, New Delhi, 2010.
4.	John R. Hackworth and Frederick D. Hackworth Jr, Programmable Logic Controllers, Pearson, New Delhi, 2004.
5.	Clarke, G., Reynders, D. and Wright, E., “Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems”, Newnes, 1st Edition, 2004.
6.	E.A.Parr, Programmable Controllers, An Engineer‟s Guide, Elsevier, 2013.

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B.E. / B.TECH	B19MEO501 - ROBOTICS (Common to all Except MECH)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts of the basic components of a robot.
2.	To apply the distinct drive systems and end effectors to control the robot actuation.
3.	To study the role and application of various types of sensors and machine vision system.
4.	To make use of the knowledge in the robot kinematics and to write Robot Programs.
5.	To identify the social and economic challenges while implementing the robot systems.

UNIT - I	FUNDAMENTALS OF ROBOT	9

Robot - Definition - Robot Anatomy Coordinate Systems, Work Envelope Types and Classification - Specifications Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions- Different Applications A view on Global and Indian manufacturers of Robots Need for Robots in Indian environment.

UNIT - II	ROBOT DRIVE SYSTEMS AND END EFFECTORS	9

Drives hydraulic, pneumatic, mechanical, electrical, Servo motors, Stepper motors - salient features, application; End effectors - types; Grippers- mechanical, pneumatic, hydraulic, magnetic, vacuum limitations, Multiple grippers.

UNIT - III	SENSORS AND MACHINE VI	9

Requirements of sensors, principles, types and applications of Proximity (Inductive, Hall effect, Capacitive, Ultrasonic and Optical); - Range (Triangulation, Structured light approach); Speed, Position (resolvers, optical encoders); - Force - Torque - Touch sensors (binary, analog sensor). Introduction to Machine Vision; applications, functions; image processing and analysis; training the vision system.

UNIT - IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	9

Forward kinematics and Reverse kinematics of manipulators; two, three degrees of freedom, homogeneous transformation matrix; introduction to manipulator dynamics, trajectory generator, manipulator mechanism, Degeneracy and Dexterity; Lead through programming, Robot programming languages; VAL programming, motion commands, sensor commands, end effecter commands, simple programs (for loading, unloading and palletizing operations), introduction to advances in Robot Programming.

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UNIT - V	APPLICATION, IMPLEMENTATION AND ROBOT ECONOMICS	9
Robot cell design; types, application of robots in processing, assembly, inspection, material handling in automobile, medical, Nuclear Industries, RGV, AGV; Implementation of Robots in Industries; S afety considerations for robot operations, safety codes, Economic analysis of robots.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the concepts of industrial robots, classification, specifications and coordinate systems.
CO2	Illustrate the different types of robot drive systems as well as robot end effectors.
CO3	Apply the different sensors and image processing techniques in robotics to Improve the ability of robots.
CO4	Develop robotic programs for different operations and familiarize with the kinematicsmotions of robot.
CO5	Examine the implementation of robots in various industrial sectors and interpolate theeconomic analysis of robots.

Text Books	
1.	Groover M.P., “Industrial Robotics - Technology Programming and Applications”, McGraw Hill, 2012.
2.	Deb S R and Deb S, “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010.
3.	Saha S K, “Introduction to Robotics”, Tata McGraw Hill Education Pvt. Ltd, 2010, 2nd Ed., 2014.

Reference Books	
1.	Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, Global Edition, 3rd Edition, 2014.
2.	Deb S.R., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Book Co., 2013.
3.	Ashitava Ghoshal, “Robotics - Fundamental Concepts and Analysis”, Oxford University Press, Sixth impression, 2010.

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Semester - VI

B.E.	B19EET601 - ELECTRICAL DRIVES AND CONTROL	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To provide fundamental knowledge in dynamics and control of Electric Drives.
2.	To understand the operation of the DC Drive controlled by Power Electronics Switches.
3.	To study and analyze the Induction motor drive control.
4.	To study and understand the Synchronous motor drive control.
5.	To understand the various digital control techniques of electric drives and applications.

UNIT - I	INTRODUCTION OF ELECTRIC DRIVES	9

Introduction: Concepts, and classification of Electric drives. Selection of motors. Dynamics of Electric drives: Types of loads, Multi quadrant operations, motor dynamics steady state stability and transient stability. Rating and Heating of motors: Heating effects, heating and cooling curves, classes of duty, load equalization, environmental factors.

UNIT - II	DC ELECTRIC DRIVES	9

Single-phase and Three-phase drives - Separately excited and series motor drives - Semiconverter and Full Converter fed drives - General Analysis - Evaluation of performance parameters - Dual Converter fed drives - Chopper fed DC drives - Single quadrant chopper controlled drives - Two quadrant and four quadrant chopper controlled drives.

UNIT - III	CONTROL OF INDUCTION MOTOR DRIVES	9

VSI and CSI fed induction motor drives - principles of V/f control - closed loop variable frequency PWM inverter with dynamic braking - static Scherbius drives - power factor considerations - modified Kramer drives - principle of vector control - implementation - block diagram, Design of closed loop operation of V/f control of Induction motor drive systems.

UNIT - IV	CONTROL OF SYNCHRONOUS MOTOR DRIVES	9

Open loop VSI fed drive and its characteristics - Self-control - Torque control - Torque angle control - Power factor control - Brushless excitation systems - Field oriented control - Design of closed loop operation of Self-control of Synchronous motor drive systems.

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UNIT - V	DIGITAL CONTROL AND DRIVE APPLICATIONS	9
Digital techniques in speed control - Advantages and limitations - Microprocessor/Microcontroller and PLC based control of drives -Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor drive.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Identify the characteristics of motors, load dynamics and performance parameters of drives for different applications.
CO2	Analyze the performance of converter and chopper controlled DC Drives in different quadrants
CO3	Choose the various control strategies and controllers for Induction Motor Drive Systems.
CO4	Select the various control schemes for Synchronous motor drives and analyze its functions.
CO5	Outline the operation of digital techniques in speed control of Electric Drives.

Text Books	
1.	Dubey G.K., "Fundamentals of Electrical Drives", 2nd Edition, Narosa Publishing House, New Delhi, 2015.
2.	Vedam Subramanyam, "Electric Drives: Concepts and Applications", 2nd Edition, Tata McGraw hill Private Limited, New Delhi, 2011.
3.	Bose, B.K., "Modern Power Electronics and AC Drives", 2nd Edition, Prentice Hall of India, 2005.

Reference Books	
1.	Krishnan R, "Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall of India Private Limited, New Delhi, 2010.
2.	Ion Boldea and S. A. Nasar", Electric Drives", CRC Press LLC, New York, 1999.

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B.E.	B19EET602 - POWER SYSTEM - I	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To model the power system network under steady state operating condition.
2.	To impart knowledge on computational analysis of power flow in a network.
3.	To analyse & interpret the fault condition in a power system network under symmetrical network.
4.	To analyse & interpret the fault condition in a power system network under unsymmetrical network.
5.	To model and analyse stability problems in power system.

UNIT - I	AN OVERVIEW AND MODELLING OF THE POWER SYSTEM	9

Introduction - Structure of Electric Power System - Modeling of Power System Components - Single line diagram - Impedance Diagram - Reactance Diagram - Per unit System - Network Modeling - Formation of bus admittance matrix (YBUS) - Formation of bus impedance matrix (ZBUS) without mutual coupling - basic graph theory.

UNIT - II	POWER FLOW ANALYSIS	9

Introduction - Bus Classification - Load Flow Equations - Load flow methods - Gauss-Seidel Method - Newton-Raphson Method - Fast Decoupled Method - Computation of slack bus power and transmission line losses - Comparison of above methods.

UNIT - III	SYMMETRICAL FAULT ANALYSIS	9

Introduction - Types of Faults - Short circuit analysis of power system components: Synchronous Machine and Transmission Line - symmetrical short circuit analysis by internal emf and Thevenin's equivalent circuit methods - Thevenin's impedance - bus impedance matrix building algorithm - Short circuit capacity - Selection of circuit breakers.

UNIT - IV	UNSYMMETRICAL FAULT ANALYSIS	9

Introduction - Symmetrical Components - Sequence Impedances - Sequence Network of power system components: Synchronous Machines, Transmission Line, Transformer and Loads - Single Line to Ground Fault - Line to line Fault - Double Line to Ground Fault - Unsymmetrical fault analysis using bus impedance matrix - open conductor faults.

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UNIT - V	POWER SYSTEM STABILITY	9
Introduction - Classification of Power System Stability - Power Angle Equations - Swing Equation - Transient Stability - Equal Area Criterion - Solution of Swing Equation: Step By Step Methods, Euler's method - Critical clearing angle and time - Some factors affecting transient stability - Methods to improve steady state and transient stabilities.		
		Total Instructional hours : 45

Course Outcomes : Upon the completion of this course the students will be able to	
CO1	Interpret the different components and model of power system network.
CO2	Compute the load flow problem in a complex system.
CO3	Solve the balanced three phase faults using various methods.
CO4	Solve the unbalanced three phase faults using various methods
CO5	Analyze the impact of stability issues in power systems.

Text Books	
1.	John J. Grainger and William D.Stevenson Jr "Power System Analysis", Mcgraw Hill International Editions, 2013.
2.	Hadi Saadat, "Power System Analysis", Tata McGraw Hill, 2015.
3.	J. Duncan Glover, Thomas Overbye, Mulukutla S. Sarma,'Power System Analysis and Design', Cengage learning, 5th edition, 2016.
4.	C.L.Wadhwa, "Electrical Power Systems", New Academic Science, London, 2017.

Reference Books	
1.	D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", Tata McGraw Hill, Fourth Edition, New Delhi, 2011.
2.	C.L. Wadhwa, "Electrical Power Systems", New Age International, Seventh Edition, 2016.
3.	M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A.Chakrabarti, "A Text Book on Power System Engineering", Dhanpat Rai & Co., 2013.
4.	Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan, "Electrical Power Systems-Analysis, Security and Deregulation", PHI Learning Private Limited, New Delhi, 2012

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B.E.	B19EET603 - EMBEDDED AND REAL TIME SYSTEMS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts of embedded systems.
2.	To learn about the bus communication protocols.
3.	To study the various Embedded Product Development Strategies.
4.	To know about the basics of Real Time operating Systems.
5.	To learn about the design examples and case studies of Embedded System applications.

UNIT - I	INTRODUCTION TO EMBEDDED SYSTEMS	9

Introduction to Embedded Systems - Structural units in Embedded processor, selection of processor & memory devices - DMA - Memory management methods - Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging. Characteristics and quality attributes (Design Metric) of embedded system. Real time system's requirements, real time issues, interrupt latency.

UNIT - II	EMBEDDED NETWORKING	9

Embedded Networking: Introduction, I/O Device Ports & Buses- Serial Bus communication protocols RS232 standard - RS422 - RS 485 - CAN Bus -Serial Peripheral Interface (SPI) - Inter Integrated Circuits (I2C) - Field-bus-Types and Comparison, USB, Bluetooth, Zig-Bee, Wireless sensor network- parallel bus device protocols -ISA,PCI,PCI-X and Advanced buses- Need for device drivers.

UNIT - III	EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT	9

Embedded Product Development Life Cycle - objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Program modelling concepts: Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model, Petri-net, UML.

UNIT - IV	RTOS BASED EMBEDDED SYSTEM DESIGN	9

Introduction to basic concepts of RTOS- Need of RTOS in Embedded System Software, Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication - synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance. RTOS services in contrast with traditional OS- Foregroud/Background Systems.

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UNIT - V	EMBEDDED SYSTEM APPLICATION	9
Case Study of an Automated Meter Reading System - Smart card System Application - ATM machine - Washing Machine - Digital camera - Mobile Phone Software for Key Inputs Role of an Embedded System in E-transportation.		
		Total Instructional hours : 45

Course Outcomes : Upon the completion of this course the students will be able to	
CO1	Explain the basic concepts of embedded systems
CO2	Classify the bus communication protocols
CO3	Compare the various Embedded Product Development Strategies
CO4	Outline the basics of Real Time operating Systems
CO5	Demonstratethe design examples and Embedded System applications

Text Books	
1.	Shibu. K.V, “Introduction to Embedded Systems”, 2e, Mc graw Hill, 2017.
2.	Raj Kamal, ‘Embedded System - Architecture, Programming, Design’, Mc Graw Hill, 2013.
3.	Peckol, “Embedded system - A Contemporary Design tool”, 2e, John Wiley & Sons,2019.

Reference Books	
1.	Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013.
2.	C.R.Sarma, “Embedded Systems Engineering”, University Press (India) Pvt. Ltd, 2013.
3.	Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.
4.	Han-Way Huang, “Embedded system Design Using C8051”, Cengage Learning, 2009.
5.	Rajib Mall “Real-Time systems Theory and Practice” Pearson Education, 2007

BoS Chairman

B.E.	B19EEP601 - ELECTRICAL DRIVES AND CONTROL LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To study and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.
2.	To study and understand the operation of both classical and modern induction motor drives.
3.	To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives.
4.	To analyze and design the current and speed controllers for a closed loop solid-state DC motor drives.
5.	To study the characteristics of special machines by digital techniques.

List of Experiments

Expt. No.	Description of the Experiments
1.	Simulation of closed loop control of converter fed DC motor.
2.	Simulation of closed loop control of chopper fed DC motor.
3.	Simulation of VSI fed 3Φ induction motor.
4.	Simulation of 3Φ synchronous motor drive.
5.	Speed control of DC motor using 3Φ Rectifier.
6.	Speed control of 3Φ induction motor using PWM inverter.
7.	DSP based closed loop drive for induction motor.
8.	Speed control of Brush Less DC motor using DSP.
9.	DSP based chopper fed DC motor drive.
10.	Switched Reluctance Motor Drive using DSP.
	Total Instructional hours : 60

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Course Outcomes : Students will be able to	
CO1	Apply simulation software to analyze vector control of induction motors.
CO2	Analyze the operation of induction machines, synchronous machines,DCMachines, Switched Reluctance Motor.
CO3	Analyze the operation of speed control of induction motor drives in an energy efficient manner using power electronics.
CO4	Experiment with Pulse width modulation for a 3-Phase inverter driven induction motor drive with Digital Signal Processor.
CO5	Analyze the single phase and three phase fully controlled converter and Chopper fed separately excited dc motor drives.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity required
1.	MATLAB Software	10
2.	Personal Computer	10
3.	Three phase IGBT based power module (Smart power module)	3
4.	TMS 320 LF 2407 / 16 DSP trainer kit	3
5.	Signal conditioning card	3
6.	Chopper / Inverter PWM controller	1
7.	Three phase SCR module	1
8.	DSPIC30F4011controller trainer kit	1
9.	SRM power module	1
10.	D.C. Motor with loading arrangements	1
11.	Three phase Induction motor with loading arrangements	1
12.	Brush less DC motor with loading arrangements	1
13.	Switched Reluctance Motor with loading arrangements	1
14.	Single Phase Auto Transformer	3

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B.E.	B19EEP602 - MINI PROJECT	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To provide knowledge on Electrical & Electronics Components and soldering techniques.
2.	To develop their own innovative ideas into prototype.
3.	To Design and developSmall electrical projects based on hardware and software for electrical systems.
4.	To improve the team building, communication and management skills among the students.
5.	To train the students in preparing project reports and vivavoce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Discover potential research areas in the field of Electrical & Electronics Engineering.
CO2	Survey of several available literature in the preferred field of studyliterature in the preferred field of study.
CO3	Identify, discuss and justify the technical aspects of the chosen project with a Comprehensive and systematic approach.
CO4	Construct hardware and/or software techniques for identified problems, Test and analyze the modules of planned project as an individual or in a team.
CO5	Apply engineering and management principles to achieve project goal.

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B.E.	B19CEP601 - CAREER ABILITY COURSE- III	T	P	TU	C
		0	2	0	0

Sl. No.	Topics	Hours
1.	**FUNDAMENTALS OF ELECTRIC CIRCUITS** Design and Analysis of Multiple Sources and Multiple Elements in Electrical Networks.	6
2.	**ELECTROMAGNETIC FIELDS** Computational behaviour of Electromagnetic Fields and Wave Theory.	6
3.	**FUNDAMENTALS OF ANALOG AND DIGITAL ELECTRONICS** Introduction of Electronic devices and components - Linear Circuits - Digital circuits - Applications.	6
4.	**POWER ELECTRONICS AND APPLICATIONS** Introduction to Power Semiconductor devices - Characteristics - Applications.	6
5.	**ELECTRICAL MACHINES** Generalized theory of Electric Machines (AC & DC) - Types - Characteristics - Applications.	6
		Total Instructional Hours : 30

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Professional Elective - II

B.E.	B19EEE601- ENERGY MANAGEMENT AND AUDITING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To illustrate the concepts of energy conservation and auditing.
2.	To study the concepts of economic analysis and Load management.
3.	To provide knowledge in motor and electrical equipment.
4.	To emphasize the energy management and metering.
5.	To illustrate the concept of lighting systems and cogeneration.

UNIT - I	ENERGY CONSERVATION CONCEPTS	9

Need of Energy Conservation, Energy Standards, Energy Audit, Objective, Types of energy audit- Energy Audit Methodology - understanding energy costs, Bench marking, Energy performance. Energy management basics - designing and starting an energy management program - energy accounting - energy monitoring, targeting and reporting - energy audit process. Simple Payback calculation - Energy Audit Reporting Format - Energy Audit instruments, Role of Energy Manager

UNIT - II	ENERGY COST AND LOAD MANAGEMENT	9

Important concepts in an economic analysis - Economic models - Time value of money - Utility rate structures - electricity billing - Loss evaluation - power factor - improvements and benefits - Load management: Demand control techniques - Utility monitoring and control system - HVAC and energy management - Economic justification.

UNIT - III	ENERGY MANAGEMENT FOR MOTORS AND ELECTRICAL EQUIPMENTS	9

Electrical systems - introduction - transformers - distribution losses - analysis - energy audit in electrical utilities methodology - Rewinding and motor replacement issues, Energy conservation opportunities with energy efficient motors - Star labeled energy - energy efficient motors - efficiency - motor losses - analysis.

UNIT - IV	METERING FOR ENERGY MANAGEMENT	9

Metering for energy management - Units of measure - Utility meters - Demand meters - Paralleling of current transformers - Instrument transformer burdens - Multitasking solid - state meters - smart metering - Metering location vs. requirements - Metering techniques and case studies.

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UNIT - V	LIGHTING SYSTEMS AND COGENERATION	9
Energy management in lighting systems - Task and the working space - Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques - Lighting and energy standards. Energy management by cogeneration - Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Describe the principles of Energy Audit, Management and Conservation
CO2	Explain basic concepts of economic analysis and load management.
CO3	Relate the energy management on various electrical equipment.
CO4	Illustrate the knowledge on the concepts of metering and factors influencing cost function.
CO5	Explain the concept of lighting systems, light sources and various forms of cogeneration.

Text Books	
1.	Rajiv Shanker - Energy auditing in Electrical utilities, Viva books Pvt.Ltd., 2015
2.	Amlan Chakrabarti - Energy Engineering and management, PHI, 2018
3.	Guide books for National Certification Examination for Energy Managers and Energy Auditors, Book 1, 2, 3 & 4. Bureau Energy Efficiency, New Delhi. 2005.

Reference Books	
1.	Electricity in buildings good practice guide, McGraw-Hill Education, 2016.
2.	Craig B. Smith, “Energy Management Principles”, Pergamon Press, 2015.
3.	Energy efficiency in electrical utilities, Second Edition 2005, By Bureau of Energy
4.	Efficiency, Ministry of Power, India.
5.	Energy Management - Bi-monthly journal published by National Productivity Council, New Delhi.
6.	http://www.aipnpc.org

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B.E.	B19EEE602 - HIGH VOLTAGE ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To get an overview aboutvarious types of over voltages in power system and protection methods.
2.	To understand the nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
3.	To study the methods of Generation of over voltages in laboratories.
4.	To learn thedifferent methods of Measurement of over voltages.
5.	To understand theTesting methods of Electrical power apparatus.

UNIT - I	OVER VOLTAGES AND INSULATION COORDINATION IN ELECTRICAL POWER SYSTEMS	9

Causes of over voltages and its effects on power system - Lightning Mechanism - Over voltages due to switching surges - System faults and other abnormal conditions -Bewley lattice diagram - Protection against over voltages - Insulation Coordination.

UNIT - II	DIELECTRIC BREAKDOWN INGASES, LIQUIDS AND SOLIDS	9

Classical gas laws - Ionization processes - Townsend's theory, streamer theory, Pashen's law - Gaseous breakdown non-uniform fields and Corona discharges - Vacuum breakdown - Conduction and breakdown in pure and commercial liquids - Breakdown mechanisms in solid and composite dielectrics - Solid Dielectrics Used in Practice.

UNIT - III	GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS	9

Requirements of HV generation in laboratory, Generation of High DC voltages: Rectifier - voltage Doubler - cascaded voltage multiplier circuits - electrostatic machines; Generation of High AC voltages: cascade transformers - resonance transformers and tesla coil; Generation of Impulse voltages and currents: single stage and multistage circuits - Generation of switching surge voltage - Generation of Impulse currents - Triggering and control of impulse generators.

UNIT - IV	MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS	9

Measurement of High Direct Current Voltages: High Resistance with Microammeter - Potential Dividers - Generating Voltmeters - Measurement of High A.C. and Impulse Voltages: Capacitance Potential Dividers and Capacitance Voltage Transformers - Electrostatic Voltmeters - Peak Voltmeter - Spark Gaps for Measurement of High D.C., A.C. and Impulse Voltages - Measurement of High D.C., A.C. and Impulse Currents - CRO for Impulse Voltage and Current Measurements - Digital techniques in high voltage measurement - Measurement of electric field.

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UNIT - V	HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS	9
High voltage testing of electrical power apparatus as per International and Indian standards - Non-destructive insulation test techniques: Measurement of D.C. Resistivity - Measurement of Dielectric Constant and Loss Factor- Partial Discharge Measurements - Testing of insulators - bushings - cables - isolators and circuit breakers - transformers - surge arresters - safety precautions in H.V. Labs.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Relate various causes of over voltage and its protective methods in power system also explain the Insulation Co-ordination in EHV and UHV lines.
CO2	Summarize the various breakdown mechanisms employed in Solids, Liquids and Gases dielectrics.
CO3	Utilize different type of generating circuit for generation of High DC, AC, impulse voltages and currents.
CO4	Select appropriate method of measurement techniques employed to measurement of High voltages and High currents.
CO5	Choose the appropriate method of High voltage testing for various Electrical Power Apparatus

Text Books	
1.	S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2.	E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition Elsevier , New Delhi, 2005.
3.	C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

Reference Books	
1.	L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.
2.	Subir Ray, 'An Introduction to High Voltage Engineering' PHI Learning Private Limited,
3.	Gallghar P. J. and Pearmain A. J, "High voltage measurement, Testing and Design", John Wiley & Sons, New York, 1983.

BoS Chairman

B.E.	B19EEE603 - DIGITAL CONTROL SYSTEM	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To educate on modeling and representing systems in state variable form.
2.	To explain design techniques of pole assignment and state observer using state feedback.
3.	To provide knowledge in phase plane analysis.
4.	To explain basic on digital control design for the real time analysis.
5.	To explain basicson digital State Observer.

UNIT - I	STATE SPACE ANALYSIS	9

Introduction to state concept - state equation of linear continuous time systems, matrix representation of state equations. Phase variable and canonical forms of state representation - controllable, observable, diagonal and Jordan canonical forms - solution of time invariant autonomous systems, forced system - state transition matrixrelationship between state equations and transfer function. Properties of state transition matrix - Computation of state transition matrix using Laplace transform - Cayley - Hamilton method. Conversion from canonical form to phase variable form.

UNIT - II	STATE VARIABLE DESIGN	9

Introduction to state model: Effect of state feedback - Pole placement design: Necessary and sufficient condition for arbitrary pole placement, State regulator design - Design of state observers - Separation principle - Design of servo systems: State feedback with integral control.

UNIT - III	SAMPLED DATA SYSTEM	9

Sampling process - Reconstruction of sampled signals - Hold circuits zero and first order hold - Z and Inverse Z transform - Pulse transfer function - Stability analysis using Jury‘s stability test.

UNIT - IV	DIGITAL CONTROL DESIGN	9

The digital control design with digital controller and bilinear transformation - Digital PID controller - Design with deadbeat response - Pole placement through state feedback - Design of full order state observer - Discrete Euler Lagrange Equation - Discrete maximum principle.

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UNIT - V	DIGITAL STATE OBSERVER	9
Design of Full order and reduced order observers - Design by maximum Principle: Discrete Euler Lagrange equation - Discrete maximum principle.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Develop state model with various variables and solve state space equations.
CO2	Apply the knowledgeof pole placement and state observers in control system.
CO3	Develop discrete time mathematical models in Z domain.
CO4	Interpret the concepts of digital control design.
CO5	Interpret thedesign ofbasic digital State Observer.

Text Books	
1.	M.Gopal, “Digital Control and State Variable Methods”, 4th edition, Mc Graw Hill India, 2012.
2.	K. Ogata, ‘Modern Control Engineering’, 5th Edition, Pearson, 2012.
3.	Nagrath I J and Gopal M, “Control System Engineering”, New Age International Publishers, New Delhi, 2014.
4.	M. Gopal, Digital Control Engineering, New Age Int. Pvt. Ltd., 2014

Reference Books	
1.	William S Levine, “Control System Fundamentals,” The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
2.	D.S.Naidu, “Optimal Control Systems” First Indian Reprint, CRC Press, 2009.
3.	Bernard Friedland, “Advanced Control System Design” Pearson India , 2015.
4.	Kuo, Digital Control Systems, Oxford University Press, 2nd Edition, 2003.

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B.E.	B19EEE604 - IPR AND HUMAN RIGHTS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To give an idea about IPR, registration and its enforcement.
2.	To know about the Registration of IPR
3.	To impart the knowledge on Digital Products and Law.
4.	To study the Enforcement of IPRs
5.	To appraise the students of human rights - local and international and redressal mechanism

UNIT - I	INTRODUCTION	9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad - Genesis and Development - the way from WTO to WIPO - TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations - Important examples of IPR.

UNIT - II	REGISTRATION OF IPRs	9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT - III	DIGITAL PRODUCTS AND LAW	9

Digital Innovations and Developments as Knowledge Assets - IP Laws, Cyber Law and Digital Content Protection - Unfair Competition - Meaning and Relationship between Unfair Competition and IP Laws - Case Studies.

UNIT - IV	ENFORCEMENT OF IPRs	9

Infringement of IPRs, Enforcement Measures, Emerging issues - Case Studies.

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UNIT - V	HUMAN RIGHTS	9
Human rights - meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 - watch on human rights and enforcement.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Interpret the Intellectual Property portfolio to enhance the value of the firm
CO2	Make use of IPR registration
CO3	Summarize the Digital products and laws related to Intellectual Property Rights.
CO4	Illustrate IPR Enforcement.
CO5	Summarize human rights, cultural, social and political rights.

Text Books	
1.	V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India Pvt Ltd, 2012
2.	S. V. Satakar, “Intellectual Property Rights and Copy Rights, EssEss Publications, New Delhi, 2002

Reference Books	
1.	Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2.	PrabuddhaGanguli, “Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3.	Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
4.	H.D. Agarwal, International Law and Human Rights, Central Law Publications, 2008.

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B.E.	B19CST201 - PROGRAMMING IN C	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of Structured Programming.
2.	To learn about the arrays, strings and their operations.
3.	To develop an application using functions and its methods.
4.	To develop a C program by using pointers and call by reference methods.
5.	To create a simple application using structures, Union and Files

UNIT - I	STRUCTURED PROGRAMMING	7

Algorithms, building blocks of algorithms(instructions/statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving.

UNIT - II	ARRAYS AND STRINGS	11

Introduction to C Programming - Operators and Expressions - Data Input and Output - Control Statements. Array: Defining an array - Processing an array - Multidimensional Arrays Character Arithmetic - Defining a string - NULL character - Initialization of Strings - Reading and Writing
Strings: Processing Strings -Searching and Sorting of Strings.

UNIT - III	FUNCTIONS, STORAGE CLASSES	9

Defining a function - Accessing a function - Function prototypes - Passing arguments to a function - Passing arrays to functions - Function with string - Recursion - Storage classes.

UNIT - IV	POINTERS	9

Pointer Fundamentals - Pointer Declaration - Passing Pointers to a Function - Pointers and one dimensional arrays - operations on pointers- Dynamic memory allocation.

27/7/19

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UNIT - V	STRUCTURES, UNIONS AND FILES	9
Structures and Unions: Defining a Structure - Processing a Structure - User defined data types (Typedef) - Unions. **Files:** Opening and Closing a Data File - Reading and writing a data file - Processing a data file - Unformatted data files - Concept of binary files - Accessing a file randomly using seek.		
	Total Instructional hours : 45	

Course Outcomes : Students will be able to	
CO1	Compare different problem-solving techniques.
CO2	Make use of appropriate data types and control structures for solving a Given problem.
CO3	Experiment with different array and string operations
CO4	Experiment with the usage of pointers and functions.
CO5	Organize data using structures and unions and files

Text Books	
1.	Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2016.
2.	Yashavant P. Kanetkar. “Let Us C”, 16th Edition, BPB Publications, 2016.

Reference Books	
1.	Byron S Gottfried, “Programming with C”, Schaum‟s Outlines, Fourth Edition, Tata McGraw-Hill, 2018
2.	Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2016.
3.	Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.
4.	Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.
5.	Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

27/7/19

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Professional Elective - III

B.E.	B19EEE605 - SOLAR ENERGY TECHNOLOGY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart in-depth knowledge on the solar radiation, measurements and characteristics of solar PV cell.
2.	To understand about solar thermal and photovoltaic (PV) technologies for application in buildings.
3.	To understand about solar modules and PV system design and grid connected PV systems.
4.	To develop the model of a PV system and its applications.
5.	To discuss about different energy storage systems.

UNIT - I	INTRODUCTION TO SOLAR ENERGY	9

Introduction - Characteristics of sunlight - semiconductors and P-N junctions - calculation of solar constant, Solar Radiation, Radiation Measurement, definition and calculation of solar times, definition and calculation of all solar angles and related earth angles.

UNIT - II	SOLAR PV AND THERMAL SYSTEMS	9

Solar Photovoltaic systems : Basic Principle of SPV conversion - Types of PV Systems - Types of Solar Cells - Modeling of PV Cell - Simulating the Characteristics of a PV cell - Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds- Thermal Energy storage system with PCM.

UNIT - III	STAND ALONE AND GRID CONNECTED PV SYSTEMS	9

Solar modules - MPPT - Algorithms of MPPT - Impedance control methods, Reference cell, Sampling method, Power slope methods, Hill climbing method - PV module simulation - standalone PV systems design - sizing PV systems in buildings - grid connected PV Systems.

UNIT - IV	POWER CONDITIONING SCHEMES & APPLICATIONS	9

DC Power conditioning Converters - AC Power conditioners Synchronized operation with grid supply - Harmonic problems - building integrated PV systems - Line commutated inverters - Charge controllers - Water pumping - Audio visual equipment - Street lighting.

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UNIT - V	ENERGY STORAGE SYSTEMS	9
Necessity of storage for solar energy - Types and Sizing of Batteries - Rechargeable batteries - AH rating of the batteries - Solar Energy Storage Concepts - Materials for Energy Storage - Materials for Low and High Temperature Storage Applications.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Illustrate the fundamentals of solar energy.
CO2	Develop the basic knowledge on solar PV thermal system.
CO3	Explain the issues in standalone and grid connected PV systems.
CO4	Explain the power converters used for solar energy conversion.
CO5	Outline the different energy storage systems and their performances.

Text Books	
1.	Solanki C.S., “Solar Photovoltaics: Fundamentals, Technologies And Applications”, PHI Learning Pvt. Ltd. 2015.
2.	Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI, Delhi, 2015.
3.	Stuart R. Wenham, Martin A. Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, Earthscan, UK,2007.

Reference Books	
1.	Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2011.
2.	Colleen Speigel, PEM Fuel Cell Modeling and Simulation Using MATLAB‖, Academic Press, New Delhi, 2008.
3.	Roger Messenger and Jerry Venture, “Photovoltaic Systems Engineering", CRC Press, New York, 2007.
4.	Adolf Goetzberger and Volker Hoffmann, “Photovoltaic Solar Energy Generation", Springer - Verlag Berlin Heidelberg, 2005.

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B.E.	B19EEE606 - POWER SYSTEM TRANSIENTS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To Study of Power system transients and their faults.
2.	To accord basic knowledge about Generation of switching transients and their control using circuit - theoretical concept.
3.	To understand the Mechanism of lighting strokes and the production of lighting surges.
4.	To Study of Propagation, reflection and refraction of travelling waves.
5.	To analyze the Voltage transients caused by faults, circuit breaker action, and load rejection on integrated power system.

UNIT - I	INTRODUCTION AND SURVEY	9
Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems - role of the study of transients in system planning.		

UNIT - II	SWITCHING TRANSIENTS	9
Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients - ferroresonance.		

UNIT - III	LIGHTNING TRANSIENTS	9
Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds - mechanism of lightning discharges and characteristics of lightning strokes - model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.		

UNIT - IV	TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS	9
Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.		

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UNIT - V	TRANSIENTS IN INTEGRATED POWER SYSTEM	9
The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults - switching surges on integrated system Qualitative application of EMTP for transient computation.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	CO1: Ability to understand and analyze switching and lightning transients.
CO2	CO2: Ability to acquire knowledge on generation of switching transients and their control.
CO3	CO3: Ability to analyze the mechanism of lighting strokes and voltage transients caused by faults.
CO4	CO4: Ability to understand the importance of propagation, reflection and refraction of travelling waves.
CO5	CO5: Ability to understand the concept of circuit breaker action, load rejection on integrated power.

Text Books	
1.	Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2ndEdition, 1991.
2.	Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3.	C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients - A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

Reference Books	
1.	M.S. Naidu and V.Kamaraju, 'High Voltage Engineering', McGraw Hill, Fifth Edition, 2013.
2.	Y. Hase, Handbook of Power System Engineering," Wiley India, 2012.
3.	J.L. Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.
4.	Akihiro ametani, "Power System Transient theory and applications", CRC press, 2013.

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B.E.	B19EEE607 - ELECTROMAGNETIC FIELD COMPUTATION AND MODELLING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To refresh the fundamentals of Electromagnetic Field Theory.
2.	To provide foundation in formulation and computation of Electromagnetic Fields usinganalytical and numerical methods.
3.	To impart in-depth knowledge on Finite Element Method in solving Electromagnetic fieldproblems.
4.	To understand the basic computational concept of Electromagnetic fieldproblems.
5.	To introduce the concept of mathematical modeling and design of electrical apparatus.

UNIT - I	INTRODUCTION	9

Review of basic field theory - Maxwell's equations - Constitutive relationships and Continuity equations - Laplace, Poisson and Helmholtz equation - principle of energy conversion - force / torque calculation.

UNIT - II	BASIC SOLUTION METHODS FOR FIELD EQUATIONS	9

Limitations of the conventional design procedure, need for the field analysis based design, problem definition, boundary conditions, solution by analytical methods-direct integration method - variable separable method - method of images, solution by numerical methods - Finite Difference Method.

UNIT - III	SOLUTION BY NUMERICAL METHODS	9

Finite Difference Method, Finite Element method - Charge Simulation method - Boundary Elimination method - Variational Formulation - Discretisation - Shape functions - Stiffness matrix - Energy minimization - 1D and 2D planar and axial symmetry problems.

UNIT - IV	COMPUTATION OF BASIC QUANTITIES USING FEM PACKAGES	9

Basic quantities - Energy stored in Electric Field - Capacitance - Magnetic Field - Linked Flux - Inductance - Force - Torque - Skin effect - Resistance - Simulation ofElectric & Magnetic Fields using FEM packages.

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UNIT - V	DESIGN APPLICATIONS	9
Design of Insulators - Solenoidal actuators - Transformers - Rotating machines - SRM - Induction Machines.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Solve Electromagnetic Fields from Maxwell's equations.
CO2	Explain the basic concepts about electrostatic fields &magneto static fieldsand their applications.
CO3	Identify to formulate the FEM method and use of the package.
CO4	Demonstrate the performance of electrical apparatus using Finite ElementMethod.
CO5	Apply the concepts in the design of rotating machines and transformers.

Text Books	
1.	R.Ramanujam, "Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation", I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.
2.	Gangadhar K.A. and Ramanathan P.M, "Electromagnetic Field Theory", Khanna Publishers, Delhi, 2011.
3.	Matthew N.O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 2010.

Reference Books	
1.	W.H.Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, New Delhi, 2011.
2.	John D. Kraus and Daniel A. Fleisch, "Electromagnetics with Applications", Tata McGraw Hill, 5th Edition, 2010.
3.	Nicola Biyanchi, "Electrical Machine analysis using Finite Elements", Taylor and FrancisGroup, CRC Publishers, 2005.

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B.E.	B19EEE608 - INDUSTRIAL SAFETY AND ENVIRONMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To develop an expert manpower to handle the complex industrial environment.
2.	To give knowledge about occupational health, industrial hygiene, accidental prevention techniques to the students.
3.	To make the student aware about safety auditing and management systems, pollution prevention techniques etc.
4.	To train the students about risk assessment and management.
5.	To impart fundamental knowledge about Environmental impacts and Sustainable development.

UNIT - I	INTRODUCTION	9

Introduction - Promoting Safety, Occupational Health Hazards, Safety and Health stress, Safety Psychology, Safety information system, Importance of Industrial safety, Safety in the use of machines and tools, Ergonomics of machine guarding, working areas safety requirement, operation, inspection and maintenance of industrial machines and equipment, Plant design and Housekeeping, National Building code part VIII and Building service Legislative measures in industrial safety ,Safety of Environment.

UNIT - II	RADIATION AND INDUSTRIAL HAZARDS	9

Measurement and detection of radiation intensity.Types and effects of radiation on human body, Measurement - disposal of radioactive waste and Control Different pollutants in industries and Effects on human health, Industrial Hygiene & Health- Industrial Lighting-Purpose of lighting and design Uses of good illumination, recommended optimum standards of illumination, Testing and Maintenance of ventilation systems, Vibration and Noise-Vibration- effects, Measurement & control, Practical aspects of control of noise.

UNIT - III	INDUSTRIAL SAFETY & STANDARDS	9

Introduction of safety in mines, nuclear plants, chemical, textile, process, construction, transport industry, Electrical safety - Safe limits of amperages, voltages, distance from lines, etc., Joints and connections, Overload and Short circuit protection, Earthing standards and earth fault protection, Protection against voltage fluctuations, Effects of shock on human body Hazards, Electrical equipment in hazardous atmosphere, Criteria - selection, installation, maintenance and use, static electricity hazards - OHSAS 18000 AND ISO 14000 standards.

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UNIT - IV	HAZARDS ACCIDENT PREVENTION TECHNIQUE	9
General causes and classification of fire, Detection of fire, extinguishing methods, fire-fighting installations with and without water. Machine guards and its types, High pressure hazards, safety, emptying, inspecting, repairing, hydraulic and nondestructive testing, hazards and control in mines. Principles of accidents prevention, Theories and principles of accident causation, first aid, Personal Protective Equipment's.		

UNIT - V	ENVIRONMENTAL IMPACTS AND SUSTAINABLE DEVELPOMENT	9
Environmental education - Population and community ecology - Natural resources conservation - Environmental protection and law ,assessment for different disaster types - national policies - objectives and standards - physical event modification - preparedness, forecasting and warning, land use planning, Introduction to Sustainable Development - Bio Diversity - Atmospheric pollution - Global warming and Ozone Depletion - ODS banking and phasing out-Sea level rise - El Nino and climate changes - Eco friendly products - Green movements - Green philosophy - Environmental Policies - Environmental Impact Assessment - case studies - Life cycle.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations.
CO2	Identify accident prone areas and adopt methods for reducing accidents following safety precautions with suitable measurement and controls.
CO3	Identify and apply safety policy in an industry and implement Standards, Practices.
CO4	Identify the various hazards and prevention techniques.
CO5	Select, plan and implement sustainable development goals on environmental impacts.

Text Books	
1.	Ratan Raj Tatiya, “Elements of industrial hazards: health, safety, environment and loss prevention”CRC Press, Balkema, 2011.

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2.	Alston, Frances, Millikin, Emily J, "Guide to environment safety and health management : developing, implementing and maintaining a continuous improvement program"CRC Press, 2015.
3.	Roland P. Blake, "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973.

Reference Books	
1.	L M Deshmukh, "Industrial safety management", TATA McGraw Hill, 2010
2.	Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
3.	John Ridley, "Safety at Work", Butterworth & Co., London, 1983.
4.	Environmental Policy Integration: An Introduction. Stockholm Environment Institute, Person A. 2004.
5.	T. Katyal, Environmental pollution. Delhi, India (2001).

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B.E.	B19EEE609 - INTRODUCTION TO ARTIFICIAL INTELLIGENCE	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To expose the concepts of Artificial neural networks
2.	To provide adequate knowledge about Artificial neural networks architectures and its applications.
3.	To teach about the concept of fuzziness involved in various systems.
4.	To provide adequate knowledge about fuzzy Logic Control.
5.	To expose the ideas of optimization and control in engineering problems.

UNIT - I	FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS	9

Introduction - Biological neuron - Artificial neuron - Neuron modeling - Learning rules - Singlelayer - Multi layer feed forward network - Back propagation - Learning factors.

UNIT - II	ANN - ARCHITECTURE AND APPLICATIONS	9

Feedback networks - Discrete time Hopfield networks - Transient response of continuous time networks - Process modeling using ANN - Neuro controller for inverted pendulum - Stability analysis of Neural - Network interconnection systems.

UNIT - III	FUZZY SYSTEMS	9

Classical sets - Fuzzy sets - Fuzzy relations - Fuzzification - Membership functions - Defuzzification - Methods of defuzzification - Fuzzy rules.

UNIT - IV	FUZZY LOGIC CONTROL	9

Membership function - Knowledge base - Decision-making logic - Adaptive fuzzy system - FLC for inverted pendulum - Homeheating system - Introduction to Neuro-fuzzy systems - Implementation of fuzzylogic controller using Matlab fuzzy - logic toolbox. Stability analysis of fuzzy controlsystems.

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UNIT - V	OPTIMIZATION TECHNIQUES	9
Gradient Search - Non-gradient search - Genetic Algorithms: Operators, search algorithm, penalty - Evolutionary Programming: Operators, Search Algorithms.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Demonstrate the theoretical concepts of Artificial Neural Networks and Learning.
CO2	Make use of the neural network architectures for simple applications.
CO3	Illustrate the concepts of fuzzy systems involved in various systems.
CO4	Apply the acquired knowledgeabout fuzzy set theory into simple problems.
CO5	Summarize the optimization techniques and control in engineering problems.

Text Books	
1.	Laurance Fausett, ‘Fundamentals of Neural Networks’, Pearson Education, 2019.
2.	S. Rajasekaran, G. A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications”, EssEss Publications, New Delhi, 2011.
3.	David Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning’, Pearson Education, 2007

Reference Books	
1.	S N Sivanandam, S Sumathi, S N Deepa "Introduction to Neural networks using MATLAB 6.0", Tata Mc Graw Hills, 2006.
2.	Timothy J. Ross, ‘Fuzzy Logic with Engineering Applications’, McGraw Hill, 1997.
3.	Jacek M. Zurada, ‘Introduction to Artificial Neural Systems’, Jaico Publishing home, 2002.
4.	Laurance Fausett, ‘Fundamentals of Neural Networks’, Pearson Education, 2004.

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Open Elective - II

B.E. / B.TECH	B19AEO601 - AIRCRAFT ELECTRICAL AND ELECTRONIC SYSTEMS (Common to all Except AERO)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the working principles of aircraft engine and fuel systems.
2.	To understand the lighting technologies and pressurization system of the aircraft cabin.
3.	To realize the warning and protection systems of the aircraft.
4.	To expose on terrain warning systems of the safety of the aircraft.
5.	To gain knowledge on FDR and anti-fire protection system.

UNIT - I	AERO ENGINE AND FUEL MANAGEMENT SYSTEMS	9

Introduction to Starting and Ignition Systems - Primary, secondary and Electronic Indicating Systems. Fuel Management system - Fuel quantity measurement and indication - Fuel feed and distribution - Fuel transfer - Refueling and defueling - Fuel jettison - Fuel Tank Venting and Inerting.

UNIT - II	LIGHTS AND CABIN SYSTEMS	9

Overview of Lighting technologies - Flight compartment lights - Passenger cabin lights - Exterior lights. Cabin systems - Passenger address system - Galley equipment - In-flight entertainment - Satellite communications - Air conditioning - Pressurization - Airstairs.

UNIT - III	WARNING AND PROTECTION SYSTEMS	9

Stall warning and protection - Airframe ice and rain protection - Windscreen ice and rain protection - Anti-skid - Configuration warning - Aural warnings.

UNIT - IV	TERRAIN AWARENESS WARNING SYSTEM	9

System overview - System warnings and protection - External references - Ground proximity modes - Forward - looking terrain avoidance - Rotorcraft TAWS - Architecture and configurations.

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UNIT - V	FLIGHT DATA RECORDER AND FIRE PROTECTION SYSTEM	9
Introduction to FDR - Equipment Requirement - FDR Specifications - Cockpit Voice Recorders - Health and usage monitoring system. Fire Protection - Engine fire Detection - Cargo Bay Area- Fire Extinguishing systems.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the Basics of Ignition and Fuel System of an Aircraft. (K2)
CO2	Illustrate the Flight Compartment Lighting Technologies and Cabin Air Conditioning system. (K2)
CO3	Identify the Warning and Protection Systems for the Ice Formation and Rain in the Airframe of the Aircraft During Flight. (K3)
CO4	Apply the Terrain Warning Systems to avoid the Terrain Collision of an Aircraft. (K3)
CO5	Examine the FDR and Fire Protection System to Monitor the Flying Performance of the Aircraft. (K4)

Text Books	
1.	“Aircraft Electrical and Electronic Systems”, Principles, operation and maintenance by Mike Tooley and David Wyatt.

Reference Books	
1.	Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2011.
2.	Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1993.
3.	Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000.

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B.E. / B.TECH	B19AGO601- INTEGRATED WATER RESOURCES MANAGEMENT (Common to all Except AGRI)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the key elements of IWRM.
2.	To know about the water economics and policies related to IWRM.
3.	To understand the water supply with reference to human health.
4.	To learn the concept of water security for agriculture practices.
5.	To know the water regulation acts and international water scenarios.

UNIT - I	CONTEXT FOR IWRM	9

Water as a global issue: key challenges and needs - Definition of IWRM within the broader context of development - Complexity of the IWRM process - Examining the key elements of IWRM process.

UNIT - II	WATER ECONOMICS	9

Economic view of water issues: economic characteristics of water good and services - Non-market monetary valuation methods - Water economic instruments, policy options for water conservation and sustainable use - Private sector involvement in water resources management - PPP experiences through case studies.

UNIT - III	WATER SUPPLY AND HEALTH WITHIN THE IWRM CONSIDERATION	9

Links between water and human health: options to include water management interventions for health - Health protection and promotion in the context of IWRM - Health impact assessment of water resources development.

UNIT - IV	AGRICULTURE IN THE CONCEPT OF IWRM	9

Water for food production: blue‟ versus “green‟ water debate - Conjunctive use of surface and groundwater - Virtual water trade for achieving global water security -- Irrigation efficiencies, irrigation methods and current water pricing.

UNIT - V	WATER LEGAL AND REGULATORY SETTINGS	9

Basic notion of law and governance: principles of international and national law in the area of water management. Understanding UN law on non-navigable uses of international water courses - Development of IWRM in line with legal and regulatory framework.

Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Explain the concepts of IWRM.
CO2	Build an economic conservation of water under PPP and IWRM.
CO3	Identify the linkages between human health and water
CO4	Summarize the water use effectiveness in agriculture.
CO5	Make use of knowledge on regulatory acts and policies of water

Reference Books	
1.	Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
2.	Technical Advisory Committee, Poverty Reduction and IWRM, Technical Advisory Committee Background paper no: 8. Global water partnership, Stockholm, Sweden, 2003.
3.	Technical Advisory Committee, Regulation and Private Participation in Water and Sanitation section, Technical Advisory Committee Background paper No:1. Global water partnership, Stockholm, Sweden, 1998.
4.	Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
5.	Technical Advisory Committee, Water as social and economic good: How to put the principles to practice”. Technical Advisory Committee Background paper No: 2. Global water partnership, Stockholm, Sweden, 1998.
6.	Technical Advisory Committee, Effective Water Governance”.Technical Advisory Committee Background paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
7.	Cech Thomas V., “Principles of water resources: history, development, management and policy”, John Wiley and Sons Inc., New York. 2003.
8.	Mollinga .P. etal, “Integrated Water Resources Management”, Water in South Asia Volume I, Sage Publications, 2006.
9.	Iyer R. Ramaswamy, “Towards Water Wisdom: Limits, Justice, Harmony”, Sage Publications, New Delhi, 2007.
10.	https://nptel.ac.in/courses/105/105/105105110/

BoS Chairman

B.E. / B.TECH	B19BMO601 - INTRODUCTION TO BIOMEDICAL ENGINEERING (Common to all Except BME)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of biomedical engineering technology
2.	To learn the working principles of diagnostic devices
3.	To study the principles of therapeutic devices
4.	To know the concepts of medical imaging techniques present in biomedical field.
5.	To learn various prevention and safety tools

UNIT - I	INTRODUCTION TO BIOMEDICAL ENGINEERING	9

Introduction - History of medical devices - Characteristics of human anatomy and physiology that relate to medical devices - Electrical signals and conductivity - Physiological monitoring systems.

UNIT - II	DIAGNOSTIC DEVICES AND MEASUREMENTS	9

ECG Machine - Blood pressure measurements - Temperature measurements - Pulse oximeters - Biochemical analysers - Blood flow detectors - Respiration monitor.

UNIT - III	THERAPEUTIC DEVICES AND MEASUREMENTS	9

Introduction - Defibrillators- Pacemakers - Ventilators - Heart lung machine - CPAP/BPAP - Humidifiers.

UNIT - IV	DIAGNOSTIC IMAGING	9

Basic Principles of X-ray- CT -MRI - PET - SPECT

UNIT - V	PREVENTION AND PATIENT SAFETY TOOLS	9

Electrical Safety - testing methods - other safety considerations - Troubleshooting techniques - general test equipment - Specialized biomedical test equipment - tools.

Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Outline the basics of biomedical Engineering
CO2	Discuss about the diagnostic devices and measurements
CO3	Summarize about the therapeutic devices and measurements
CO4	Explain about diagnostic imaging
CO5	Describe about prevention and patient safety tools

Reference Books	
1.	Laurence J. Street, “Introduction to Biomedical Engineering Technology”, 3rd Edition, CRC Press, 2017.
2.	John Enderle, “Introduction to Biomedical Engineering”, 3rd Edition, Academic Press, 2011.
3.	Germin Nisha. M, John Robert Prince. M, Sivagama Sundari Meenakshi Sundaram, “Bio-Medical Instrumentation: Medical Applications”, Lambert Academic Publishing, 2020
4.	Shakti Chatterjee, Aubert Miller, “Biomedical Instrumentation Systems”, Thomson Press (India) Ltd, 2012

BoS Chairman

B.E. / B.TECH	B19BTO601 - BASIC BIOINFORMATICS (Common to all Except BT)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the units of various physical parameters, conversion factors.
2.	To understand about the various material balances and difference between steam and heat and their balances.
3.	To explain about the application of energy balance in bioprocesses.
4.	To explain about the fluid flow in packed columns and their flow patterns.
5.	To understand about the process of agitation and various agitator vessels.

UNIT - I	BIOLOGICAL DATABASES	9

Biological databases - types of databases - DNA database: GenBank, EMBL - DNA database: ESTs, STS, HTGS- NCBI, Pubmed, Entrez, BLAST, OMIM - Protein databases: SWISSPORT, PIR - DNA and protein sequences: ExPASy, Locus link, Unigene, Entrez, EBI, IMGT.

UNIT - II	SEQUENCE ALIGNMENT	9

Multiple sequence alignment - models of sequence alighment- databases of sequence alignments: SMART, Pfam - Conserved domains in biomolecules - databases of conserved domains: PRINTS, BLOCKS - integrated multiple sequence alighment - ClustalW, ClustalX, Interpro, MetaFam, PopSet resources of sequence mining.

UNIT - III	DATABASE SEARCH	9

Sequence homology - similarity, identity and sequence gaps - Pairwise alignment, detection, significance and limitations: Needleman Wunsch, Smith Waterman Algorithm - BLAST: List, scan, extent, E value and P value, alignment, search strategies - principles of BLAST search - types of BLAST.

UNIT - IV	STRUCTURE PREDICTION TOOLS	9

Analysis of 3D protein structure data - protein data bank (PDB) - SCOB - CATH - Dali Domain directory - FSSP - Protein structure modeling - comparative modeling - Abinitio prediction - Threading - Protein folding.

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UNIT - V	EVOLUTION ANALYSIS	9
Phylogenetic analysis and molecular evolution - nomenclature of phylogenetic trees - interpretation of phylogenetic data - phenotypic and gene trees - molecular visualization - tools of visualization: Swiss PDB viewer, RasMol, QMol - applications of phylogeny and molecular visualization.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Recall the basics of about Bioinformatics tools
CO2	Outline the numerous algorithms for sequence alignments
CO3	Explain about a brief knowledge on similarity analysis
CO4	Illustrate about the structural genomics of ancestry
CO5	Make use of brief understanding of evolution study

Text Books	
1.	David W M, “Bioinformatics: Sequence and Genome Analysis”, CBS publishers, New York, 2004.

Reference Books	
1.	Attwood TK and DJP Smith, “Introduction to Bioinformatics”, Addison Wesley Longman Limited, 1999.
2.	Mount DW, “Bioinformatics Sequence and Genome Analysis”, Cold Spring Harbour Laboratory Press, 2001.
3.	Pevsner J, “Bioinformatics and Functional Genomics”, John Wiley, 2003.
4.	Rastogi SC, Mendiratta N, Rastogi P, “Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery”, 3rd Edition, Prentice Hall Inc. 2005.

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B.E. / B.TECH	B19CSO601 - E-COMMERCE TECHNOLOGY AND MANAGEMENT (Common to all Except CSE, AI&DS, CSBS)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To learn the E-Commerce Platform and its concepts.
2.	To understand the Technology, infrastructure and Business in E-Commerce.
3.	To understand the Security and Challenges in E-Commerce.
4.	To build an own E-Commerce using Open Source Frameworks.
5.	To apply the security and learn the payment systems.

UNIT - I	INTRODUCTION	9

Infrastructure : Working of Web - Web Browsers - Traditional commerce and E commerce - Internet and WWW - role of WWW - value chains - strategic business and Industry value chains - role of E commerce.

UNIT - II	BUILDING E-COMMERCE SITES AND APPS	9

Systematic approach to build an E-Commerce - Planning - System Analysis - System Design - Building the system - Testing the system - Implementation and Maintenance, Optimize Web Performance -Choosing hardware and software - Other E-Commerce Site tools - Developing a Mobile Website and Mobile App.

UNIT - III	E-COMMERCE SECURITY AND PAYMENT SYSTEMS	9

E-Commerce Security Environment - Security threats in E-Commerce - Technology Solutions: Encryption - Securing Channels of Communication - Protecting Networks - Protecting Servers and Clients - Management Policies - Business Procedure and Public Laws - Payment Systems.

UNIT - IV	BUSINESS CONCEPTS IN E-COMMERCE	9

Digital Commerce Marketing and Advertising strategies and tools - Internet Marketing Technologies - Social Marketing - Mobile Marketing - Location based Marketing - Ethical- Social - Political Issues in E-Commerce

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UNIT - V	TOOLS FOR E-COM	9
Web server - performance evaluation - web server software feature sets - web server software and tools - web protocol - search engines - intelligent agents - EC software - web hosting - cost analysis - Mini Project: Develop E-Commerce project in any one of Platforms like Woo-Commerce, Magento or Opencart.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Build Website using HTML CSS and JS.
CO2	Develop Responsive Sites.
CO3	Infer Manage, Maintain and Support Web Applications.
CO4	Choose the marketing and advertising strategies and tools for marketing.
CO5	Identify the security technique and learn the payment systems.

Text Books	
1.	Kenneth C.Laudon, Carol Guercio Traver “E-Commerce”, Pearson, 10^{th} Edition, 2016.
2.	Harvey M. Deitel, Paul J.Deitel, Kate Steinbuhler, e-business and e-commerce for managers, Pearson, 2011.

Reference Books	
1.	Robbert Ravensbergen, “Building E-Commerce Solutions with Woo Commerce”, PACKT, 2^{nd} Edition
2.	Parag Kulkarni, Sunita Jahirabad kao, “Pradeep Chande, e-business”, Oxford University Press, 2012.
3.	Kala kota et al, “Frontiers of Electronic Commerce”, Addison Wesley, 2004.
4.	Micheal Papaloelon and Peter Robert, “E-business”, Wiley India, 2006.
5.	Efraim Turban, Jae K.Lee, avid King, Ting Peng Liang, Deborrah Turban, “Electronic Commerce - A managerial perspective”, Pearson Education Asia, 2010.

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B.E. / B.TECH	B19ECO601 - GEOGRAPHIC INFORMATION SYSTEM (Common to all Except ECE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamentals and components of Geographic Information System.
2.	To provide details of spatial data models.
3.	To understand the input topology.
4.	To study the data analysis tools.
5.	To introduce the marketing and business applications.

UNIT - I	FUNDAMENTALS OF GIS	9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems - Definitions - History of GIS - Components of a GIS - Hardware, Software, Data, People, Methods - Proprietary and open source Software - Types of data - Spatial, Attribute data- types of attributes - scales / levels of measurements.

UNIT - II	SPATIAL DATA MODELS	9

Database Structures - Relational, Object Oriented - ER diagram - spatial data models - Raster Data Structures - Raster Data Compression - Vector Data Structures - Raster vs Vector Models - TIN and GRID data models - OGC standards - Data Quality.

UNIT - III	DATA INPUT AND TOPOLOGY	9

Scanner - Raster Data Input - Raster Data File Formats - Vector Data Input - Digitiser - Topology - Adjacency, connectivity and containment - Topological Consistency rules - Attribute Data linking - ODBC - GPS - Concept GPS based mapping.

UNIT - IV	DATA ANALYSIS	9

Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation.

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UNIT - V	APPLICATIONS	9
GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the basic idea about the fundamentals of GIS
CO2	Summarize the types of data models
CO3	Analyse about data input and topology
CO4	Analyse about tools and models used for data analysis
CO5	Interpret the data management functions and data output

Text Books	
1.	Kang - Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.
2.	Ian Heywood, Sarah Cornelius, Steve Carver, SrinivasaRaju, "An Introduction Geographical Information Systems", Pearson Education, 2nd Edition, 2007.

Reference Books	
1.	Lo.C.P, Albert K.W. Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice - Hall India Publishers, 2006.

R. Gowri

BoS Chairman

B.E. / B.TECH	19MEO601 - ENTREPRENEURSHIP DEVELOPMENT (Common to all Except MECH)	L	P	TU	C
		3	0	0	3

Course Objectives	
1.	To interpret the entrepreneurial aspects.
2.	To comprehend the distinct inspirational practices to execute entrepreneurial plans.
3.	To introduce various elements involved in establishing a business.
4.	To understand the sources of finance and accounting.
5.	To throw the light on various supporting institutions for the entrepreneurs.

UNIT - I	ENTREPRENEURSHIP	9

Entrepreneur - Types of Entrepreneurs - Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT - II	MOTIVATION	9

Major Motives Influencing an Entrepreneur - Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test - Stress Management, Entrepreneurship Development Programs - Need, Objectives.

UNIT - III	BUSINESS	9

Small Enterprises - Definition, Classification - Characteristics, Ownership Structures - Project Formulation - Steps involved in setting up a Business - identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment - Preparation of Preliminary Project Reports - Project Appraisal - Sources of Information - Classification of Needs and Agencies.

UNIT - IV	FINANCING AND ACCOUNTING	9

Need - Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation - Income Tax, Excise Duty - Sales Tax.

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UNIT - V	SUPPORT TO ENTREPRENEURS	9
Sickness in small Business - Concept, Magnitude, Causes and Consequences, Corrective Measures Business Incubators - Government Policy for Small Scale Enterprises - Growth Strategies in small industry - Expansion, Diversification, Joint Venture, Merger and Sub Contracting.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Classify and compare the entrepreneurship in society.
CO2	Identify the interpersonal attributes needed to become entrepreneur.
CO3	Demonstrate the various facets of business.
CO4	Summarize the components of finance and accounting.
CO5	Outline the comprehensive business entities.

Text Books	
1.	Donald F Kuratko, "Entrepreneurship - Theory, Process and Practice", 9th Edition, Cengage Learning, 2014.
2.	Khanka. S.S., "Entrepreneurial Development", S. Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.

Reference Books	
1.	Hisrich R D, Peters M P, "Entrepreneurship", 8th Edition, Tata McGraw-Hill, 2013.
2.	Rajeev Roy, "Entrepreneurship", 2nd Edition, Oxford University Press, 2011.

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Semester - VII

B.E.	B19EET701 - POWER SYSTEM - II	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart the knowledge on power system operation and control.
2.	To model and interpret the real power - frequency interaction and design of power - frequency controller.
3.	To model and interpret the reactive power - voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
4.	To model and analyse the economic operation of the power system.
5.	To impart the knowledge on SCADA and its application for real time operation and control of power systems.

UNIT - I	INTRODUCTION	9

Systemload - variation - load characteristics - load curve sand load - duration curve (daily, weekly and annual) - load factor - diversity factor - Utilisation factor - Demand factor. Load forecasting - Importance of load forecasting and simple techniques of forecasting - An overview of power system operation and control - Load Dispatch Centre - Classification - Functions - State transition diagram.

UNIT - II	REAL POWER - FREQUENCY CONTROL	9

Basics of speed governing mechanism and modelling - speed - load characteristics -load sharing between two synchronous machines in parallel. Control are a concept LFC control of a single area system - Static and dynamic analysis of uncontrolled and controlled cases -Two area system - tieline with frequency bias control of two - area system.

UNIT - III	REACTIVE POWER - VOLTAGECONTROL	9

Basics of reactive power control - Excitation systems - modelling - Static and dynamicanalysis - stability compensation - generation and absorption of reactive power - method ofvoltage control - tap - changing transformer - System level control using generator voltage magnitude setting - tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

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UNIT - IV	ECONOMIC OPERATION OF POWER SYSTEM	9
Statement of Unit Commitment problem - constraints - spinning Reserve - thermal unit constraints - hydro constraints, fuel constraints and other constraints - Solution methods - Priority - list methods - forward dynamic programming approach - Numerical problems only in priority - list method using full - load average production cost. Statement of economicdispatch problem - cost of generation - incremental cost curve co-ordination equationswithout loss and with loss - solution by direct method and λ-iteration method. (No derivationof loss coefficients) - Computer program to solve Economic dispatch and Unit commitment problem.		

UNIT - V	COMPUTER CONTROL OF POWER SYSTEMS	9
Need of computer control of power systems - Concept of energy control centre - functions - PMU - system monitoring - data acquisition and control - System hardware configuration - SCADA and EMS functions - Network topology - state estimation - security analysis and control - Various operating states - control strategies.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Build the various load characteristics with load curve, load duration curve and experiment with the modeling of power frequency dynamics.
CO2	Analyze the model for single area and two area LFC
CO3	Develop the model for AVR, the reactive power - voltage, interaction and various control methods.
CO4	Solve the Economic dispatch problems and Unit commitments problems in power systems.
CO5	Analyze the performance of power system using different computer control and its various operating states.

Text Books	
1.	Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.

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2.	Olle. I. Elgerd, 'Electric Energy Systems theory - Anintroduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 46th reprint, 2016.
3.	Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

Reference Books	
1.	D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Fourth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.
2.	Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3.	Leon K. Kirchmayer, 'Economic operation of power systems' Wiley, 2008.

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B.E.	B19EET702 - PROTECTION AND SWITCH GEAR	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the need of protection of electric equipment and their protection schemes.
2.	To acquire knowledge on power system protection and switch gear.
3.	To understand operations and characteristics of various electromagnetic and static relays.
4.	To under stand the operations of various types of circuit breakers and their ratings.
5.	To understand the over voltage protection of different apparatus in power system.

UNIT - I	INTRODUCTION	9

Principles and need for protective schemes - nature and causes of faults - types of faults - fault current calculation using symmetrical components - Power system earthing - Zones of protection and essential qualities of protection - IEC Grounding systems.

UNIT - II	PROTECTIVE RELAYS	9

Requirement of relays - Universal relay torque equation - IDMT relays : Non-directional anddirectional over current IDMT relays - Earth fault relays - Distance relays: Impedance, Mho and Reactance relays - Differential protection - Negative sequence relays - Under frequency relays.

UNIT - III	APPARATUS PROTECTION	9

Current Transformers and Potential Transformers and their applications in protection schemes - Alternator, transformer, transmission lines, Busbar and motor protection schemes - Feeder Protection: radial and ring main system.

UNIT - IV	STATIC RELAYS AND NUMERICAL PROTECTION	9

Static relays - Phase, Amplitude Comparators - Synthesis of various relays using Static comparators - Block diagram of Numerical relays - Over current protection - Relay coordination - Microprocessor based protective schemes.

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UNIT - V	CIRCUIT BREAKERS	9
Characteristics of ideal switchgear - Elementary principles of arct extinction - Arc control devices - Recovery voltage and restriking voltage - current chopping and capacitance current breaking - Air Circuit Breaker (ACB), Air Blast Circuit Breaker (ABCB), Construction and operation of bulkoil, Minimum Oil Circuit Breakers, Sulphur Hexafluoride Circuit Breaker (SF6), Vacuum Circuit Breaker (VCB), Miniature Circuit Breakers, Earth Leakage Circuit Breakers, Residual Current Circuit Breaker (RCB), Rating of Circuit Breakers, Testing of Circuit Breakers.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Interpret the causes of abnormal operating conditions of the system and its protection schemes.
CO2	Illustrate the performance of different protective relays.
CO3	Illustrate the protection schemes for electrical apparatus.
CO4	Develop Static and Numerical relays and explain Microprocessor based protection schemes.
CO5	Identify different types of circuit breakers and suggest suitability of circuit breaker in Power system.

Text Books	
1.	Sunil S. Rao, ‘Switch gear and Protection’, Khanna Publishers, New Delhi, 2015.
2.	B. Rabindranath and N. Chander, ‘Power System Protection and Switch gear’, New Age International (P) Ltd., 2018.
3.	Arun Ingole,‘Switch Gear and Protection’ Pearson Education, 2017.

Reference Books	
1.	Badri Ram, B.H. Vishwakarma, ‘Power System Protection and Switch gear’, New Age International Pvt Ltd Publishers, Second Edition 2011.
2.	Y.G. Paithankar and S.R. Bhide, ‘Fundamentals of power system protection’, Second Edition, Prentice Hall of India Pvt.Ltd., New Delhi, 2010.
3.	C.L. Wadhwa, ‘Electrical Power Systems’, 6^{th} Edition, New Age International (P) Ltd., 2018.
4.	V.K. Mehta, Rohit Mehta “Principles of Power Systems” S. Chand and Co., New Delhi., 2016.
5.	Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani, ‘Protection and Switch gear’ Oxford University Press, 2011.

BoS Chairman

B.E.	B19EEP701 - POWER SYSTEM AND RENEWABLE SYSTEMS LABORATORY	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To acquire knowledge on formation of bus admittance and impedance matrices and analyze the power flow solution of networks using GS and NR method.
2.	To understand the power system planning and operational studies.
3.	To solve the economic dispatch / operating schedule for power system.
4.	To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
5.	To recognize current and possible future role of Renewable energy sources.

List of Experiments

Expt. No.	Description of the Experiments
1.	Formation of Bus Admittance and Impedance Matrices and Solution of Networks
2.	Load Flow Analysis: Solution of load flow and related problems using Gauss- Seidel & Newton Raphson Method
3.	Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
4.	Load - Frequency Dynamics of Single- Area Power Systems
5.	Economic Dispatch in Power Systems
6.	Familiarization of Relay Testing
7.	Experiment on VI-Characteristics and Efficiency of 1kWp Solar PV System
8.	Experiment on Shadowing effect & diode based solution in 1kWp Solar PV System
9.	Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System
10.	Experiment on Performance assessment of micro Wind Energy Generator
11.	Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System
12.	Experiment on Solar PV Energy System with PV Emulator
	Total Instructional hours : 30

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Develop computer programs to form bus admittance, impedance matrices, obtain power flow solution using GS and NR methods and to solve Economic dispatch problem.
CO2	Analyze the transient stability of single machine power system and Load-Frequency Dynamics Using MATLAB simulation.
CO3	Analyze the performance of relay.
CO4	Analyze the Performance assessment of Solar PV System, micro Wind Energy Generator and Hybrid Power System.
CO5	Develop a study model of Solar PV Energy System using PV emulator with PVsyst tool.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity required
1.	Personal computers (Intel i3, 80GB, 2GBRAM)	30
2.	Printer laser	1
3.	Dot matrix	1
4.	Server (Intel i5, 80GB, 2GBRAM) (High Speed Processor)	1
5.	Power system simulation software	5 Users
6.	Compliers: C, C++, VB, VC++	30
7.	PV panels - 100W, 24V	1
8.	Battery storage system with charge and discharge control 40Ah	1
9.	Micro Wind Energy Generator module	1
10.	PV Emulator	1

BoS Chairman

B.E.	B19EEP702 - COMPREHENSION AND TECHNICAL SEMINAR	T	P	TU	C
		0	0	2	1

Course Objectives	
1.	To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.
2.	To encourage the students to study advanced engineering developments
3.	To prepare and present technical reports.
4.	To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

Course Description and Evaluation

The students will be assessed 100% internally through weekly test with objective type questions on different subject related topics studied from the first Semester to Sixth Semester of B.E Degree Course with a prior notice.

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present at least thrice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

Total Instructional Hours: 30

Course Outcomes : Students will be able to	
CO1	Summarize the knowledge of engineering fundamentals acquired from different subjects studied from the first Semester to Sixth Semester of B.E Degree Course.
CO2	Identify the advanced engineering developments, Compare and contrast the concepts studied in curriculum with the actual practice.
CO3	Develop presentation materials and give oral presentations on recent technologies.
CO4	Make use of eye contact and gestures for effective presentation.
CO5	Develop the skills to face the placement interviews.

BoS Chairman

B.E.	B19EEP703 - PROJECT WORK PHASE - I	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To develop their own innovative ideas into prototype.
2.	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
3.	To Design and develop projects based on hardware and software for electrical systems.
4.	To improve the team building, communication and management skills among the students.
5.	To train the students in preparing project reports and viva voce examination.

Project work may be assigned to a single student or to a group of students not exceeding 4 per group, under the supervision of faculty guide(s). The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three faculty members in the review committee. There shall be three reviews in total, during the semester by a review committee. The student shall make presentation on the progress made before the committee.

Interim project report shall be submitted before the project reviews with the approval of the guide. The Project Report, prepared according to the approved guidelines and duly signed by the guide and the Head of the Department, shall be submitted to the department as per the timeline announced by the department. The End Semester Examination for project work shall consist of evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted separately for each student, by a committee consisting of the external examiner, and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work.

Total Instructional Hours : 60

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Course Outcomes : Students will be able to	
CO1	Identify the problems of society with current relevance.
CO2	Apply theoretical concepts to societal/Industrial complex problems with team work and Multidisciplinary approach.
CO3	Develop the confidence for the self education, effective communication and ability for life long learning.
CO4	Design engineering solution by utilizing a systems approach with appropriate software / hardware tools for the identified problems.
CO5	Test for the software / hardware modules of the developed project.

BoS Chairman

Professional Elective - IV

B.E.	B19EEE701 - POWER ELECTRONICS APPLICATION FOR RENEWABLE ENERGY SYSTEMS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the various Non-Conventional sources of energy and the impact of renewable energy generation on environment.
2.	To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
3.	To Apply the principle of operation of electrical machines for wind energy conversion and their performance characteristics.
4.	To provide knowledge about the stand alone , grid connected renewable energy systems and grid connection issues.
5.	To understand the needs for Hybrid Renewable Energy Systems and maximum power point tracking algorithms for PV & wind Systems.

UNIT - I	INTRODUCTION TO RENEWABLE ENERGY SOURCES	9

World energy scenario - Environmental aspects of electric energy conversion : impacts of renewable energy generation on environment - Qualitative study of different renewable energy resources : Solar, wind, ocean, Biomass, Fuel cell, Geothermal Heat energy and Hydrogen energy systems.

UNIT - II	POWER ELECTRONICS FOR SOLAR PHOTO VOLTAIC SYSTEM	9

Block diagram of solar photo voltaic system - Buck / Boost and Buck - Boost converters - bidirectional converters and multilevel Inverter - Grid Interactive Inverters -selection of inverters - battery sizing, array sizing - Stand alone operation of solar system - Grid connection Issues - grid Integrated solar system - Control of Grid - Connected PV Systems.

UNIT - III	ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION	9

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

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UNIT - IV	POWER ELECTRONICS FOR WIND ENERGY CONVERSION SYSTEM	9
Introduction - Wind Energy Conversion System - Three phase AC voltage controllers, AC-DC-AC converters, uncontrolled rectifiers, PWM Inverters, matrix converters - Stand alone operation of fixed and variable speed Wind Energy Conversion Systems - Grid connection Issues - Grid integrated PMSG, SCIG Based WECS - Doubly fed induction generator with rotor side converter topologies.		

UNIT - V	HYBRID RENEWABLE ENERGY SYSTEMS	9
Need for Hybrid Systems - Range and type of Hybrid systems - Power extraction (MPP) and MPPT schemes - Case studies of Wind - PV Maximum Power Point Tracking (MPPT) - Grid connection Issues.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the operation of various Non-Conventional energy sources and the impact of renewable energy generation on environment.
CO2	Make use of power converters to develop Solar Photo Voltaic System and Wind Energy Conversion System.
CO3	Apply the operating principle of various Electrical Machines for Wind Energy Conversion System.
CO4	Interpret the stand alone and grid connected renewable energy systems.
CO5	Develop the maximum power point tracking algorithms for PV and wind Systems and explain the needs for Hybrid Renewable Energy Systems.

Text Books	
1.	B.H.Khan, “Non-conventional Energy sources” ,Tata McGraw-Hill Publishing Company, New Delhi, 2016.
2.	Sudipta Chakraborty, Marcelo G. Simes, and William E. Kramer ‘Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration’ Springer Science & Business, 2013.

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3.	Nicola Femia, Giovanni Petrone, Giovanni Spagnuolo, Massimo Vitelli, “Power Electronics and control for maximum Energy Harvesting in Photovoltaic Systems”, CRC Press, 2013.
4.	S.N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 2005.

Reference Books	
1.	Muhammad H. Rashid, “Power Electronics: Circuits, Devices, and Applications”, Pearson Education India, 2017.
2.	R.Seyezhai and R.Ramaprabha, “Power Electronics for Renewable Energy Systems”, Scitech Publications, 2015.
3.	Fang Lin Luo Hong Ye, " Renewable Energy systems", Taylor & Francis Group,2013.
4.	Remus Teodorescu, Marco Liserre, Pedro Rodriguez, Grid Converters for Photovoltaic and Wind Power Systems, John Wiley and Sons, Ltd., 2011.
5.	Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
6.	Rai. G.D, “Non conventional energy sources”, Khanna publishes, 2004.

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B.E.	B19EEE702 - FACTS AND HVDC	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the importance of controllable parameters and benefits of FACTS controllers.
2.	To study the performance of power systems with shunt compensation and series compensation devices.
3.	To study the performance of combined controllers and custom power devices in power systems.
4.	To understand the principles and types of HVDC system.
5.	To understand the operation of HVDC converters and control of HVDC system.

UNIT - I	INTRODUCTION TO FACTS	9

Principles of Real and reactive power control in electrical power transmission lines - loads and system compensation - Uncompensated transmission line - Need for FACTS controllers - basic types of FACTS controllers, IEEE definitions, FACTS devices in India.

UNIT - II	SHUNT COMPENSATION AND SERIES COMPENSATION	9

Objectives of shunt compensation - operation and control of TSC, TCR - SVC and STATCOM - Comparison between SVC and STATCOM. Objectives of series compensation - operation and control of TSSC, TCSC and SSSC -- Control schemes for series compensators - SSR and its damping.

UNIT - III	COMBINED CONTROLLERS AND CUSTOM POWER DEVICES	9

Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC). Custom power devices: Distribution STATCOM - Dynamic Voltage Restorer (DVR).

UNIT - IV	HVDC TRANSMISSION	9

DC Power transmission technology - Application of DC transmission - Configuration of HVDC system - HVDC systems in India. Power semiconductor devices used in HVDC system. Protection issues in HVDC - over voltage and over current protection. Comparison between HVDC and HVAC systems - Types of DC links.

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UNIT - V	CONTROL OF HVDC SYSTEM	9
Principles of DC link control - Converter control characteristics - Starting and stopping of DC link - Power control - Higher level controllers - Control of VSC based HVDC link, Recent trends In HVDC Transmission: CSC and VSC based HVDC system - Multi-terminal HVDC systems.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the necessity of FACTS and concept of FACTS controllers in power flow.
CO2	Analyze the functional operation and performance of various shunt and series type FACTS controllers.
CO3	Analyze the principles, operation and control of combined controller's and custom power devices.
CO4	Outline the HVDC concepts, application of HVDC systems in bulk power transmission and protection methods of HVDC systems.
CO5	Choose appropriate control strategies used for HVDC system.

Text Books	
1.	Narain Hingorani & Lazzlo Gyugi "Understanding FACTS. Concepts & Technology of FACTS", Standard publishers & distributors, 2001.
2.	Padiyar,K.R "HVDC power transmission system", New Age International (P) Ltd. New Delhi, 2017.

Reference Books	
1.	R. Mohan Mathur, Rajiv. K. Varma, "Thyristor Based FACTS Controllers for Electrical Transmission systems" John Wiley and Sons, 2011.
2.	Jos Arrillaga, Y. H. Liu, Neville R. Watson " Flexible Power Transmission: The HVDC Options", Wiley 2007.
3.	Vijay K. Sood, "HVDC and FACTS Controllers - Applications of Static Converters in Power Systems", Kluwer Academic Publishers, Massachusetts, 2004
4.	K.R. Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, 2nd Edition, 2016.

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B.E.	B19BMT501 - BIOMEDICAL INSTRUMENTATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	Illustrate origin of bio potentials and its propagations.
2.	Design bio amplifier for various physiological recordings.
3.	Know the measurement techniques of electrical parameters.
4.	Learn the different measurement techniques for non-physiological parameters.
5.	Summarize the different biochemical measurements.

UNIT - I	FUNDAMENTALS OF BIOPOTENTIAL ELECTRODES	9

Origin of bio potential and its propagation. Electrode - electrolyte interface, electrode - skin interface, half - cell potential, Contact impedance, polarization effects of electrode - non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits.

UNIT - II	SIGNAL CONDITIONING CIRCUITS	9

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier - right leg driven ECG amplifier. Band pass filtering, isolation amplifiers - transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Artifacts and removal.

UNIT - III	MEASUREMENT OF ELECTRICAL PARAMETERS	9

Bio signals characteristics - frequency and amplitude ranges. ECG - Einthoven's triangle, standard 12 lead system, Principles of vector cardiography. EEG - 10-20 electrode system, unipolar, bipolar and average mode. EMG - unipolar and bipolar mode. Recording of ERG, EOG and EGG.

UNIT - IV	MEASUREMENT OF NON-ELECTRICAL PARAMETERS	9

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

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UNIT - V	BIOCHEMICAL MEASUREMENT AND BIOSENSORS	9
Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors, colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description) - Bio Sensors - Principles - Applications.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Differentiate different bio potentials and its propagations.
CO2	Design bio amplifier for various physiological recordings.
CO3	Explain various techniques for electrical parameters.
CO4	Explain various techniques for non-electrical physiological measurements.
CO5	Demonstrate the different biochemical measurement techniques.

Text Books	
1.	Leslie Cromwell, — Biomedical Instrumentation and measurement 2nd edition, Prentice hall of India, New Delhi, 2015.

Reference Books	
1.	John G. Webster, — Medical Instrumentation Application and Design, 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
2.	Joseph J. Carr and John M. Brown, — Introduction to Biomedical Equipment Technology, Pearson Education, 2014.
3.	Myer Kutz, — Standard Handbook of Biomedical Engineering and Design, McGraw Hill Publisher, 2003
4.	Khandpur R.S, — Handbook of Biomedical Instrumentation, 3rd edition, Tata. McGraw-Hill New Delhi, 2014

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B.E.	B19EEE703 - PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To enable the students to study the evolution of management and organization.
2.	To understand the functions and principles of management.
3.	To learn the application of the principles in an organization.
4.	To create an awareness on engineering ethics and human values.
5.	To understand and appreciate the ethical issues faced by an individual in profession, society and polity.

UNIT - I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9

Meaning, Definition and Significance of Management - Basic functions of Management - Development of Management Thought - Current trends and issues in Management - Types of Business organization - Sole proprietorship, partnership, company - public and private sector enterprises - Organization culture and Environment.

UNIT - II	MANAGEMENT CONCEPTS & ORGANIZATIONAL BEHAVIOR	9

Planning, Organizing, Staffing, Directing and Controlling - MBO - Six sigma - Significance of OB, Role of Leadership, Personality and Motivation, Stress, Attitudes, Values and Perceptions at work - Case Study: Management by Objectives - Super Department Stores MBO Programme.

UNIT - III	HUMAN RESOURCE MANAGEMENT	9

Evolution of Management - Development of Managerial skills - Human Resource Management - Objectives - Job analysis - Recruitment - Selection and Placement and Training Development.

UNIT - IV	HUMAN VALUES	9

Morals, values and Ethics - Integrity - Work ethic - Service learning - Civic virtue - Respect for others - Living peacefully - Caring - Sharing - Honesty - Courage - Valuing time - Cooperation - Commitment - Empathy - Self-confidence - Character - Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.

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UNIT - V	ENGINEERING ETHICS	9
Senses of 'Engineering Ethics' - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral Autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Models of professional roles - Theories about right action - Self-interest - Customs and Religion - Uses of Ethical Theories.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the Management function for a given organization.
CO2	Analyze the behavior of individuals and groups in organizations in terms of the key factors.
CO3	Outline the procedure for recruitment, selection, training of staff to establish an organization.
CO4	Illustrate the various social problems and learn to act ethically.
CO5	Explain the ethical issues related to engineering and realize the responsibilities and rights in the society.

Text Books	
1.	Harold Koontz, Heinz Weihrich and Ramachandra Aryasri, "Principles of Management" Tata McGraw Hill, New Delhi,2013.
2.	Mamoria, CB, "Personnel Management", Sultan Chand and Sons, New Delhi 2013.
3.	M. Govindarajan, S. Natarajan and V.S. Senthilkumar, "Engineering Ethics", Prentice Hall of India, 1st Edition, 2009.

Reference Books	
1.	Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
2.	Henry Dreyfuss, "The Measure of Man and Woman: Human Factors in Design", John Wiley and Sons Publications, 2012.
3.	Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4.	World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.
5.	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 4th Edition, NewYork, 2005.

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B.E.	B19EEE704 - MACHINE LEARNING FOR ELECTRICAL ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic concepts and techniques of Machine Learning.
2.	To identify the fault in electric drive using Machine learning Algorithm.
3.	To describe various equipment used for power quality monitoring.
4.	To understand preventive maintenance strategies.
5.	To become familiar with aspects of analysis and control of power system problems.

UNIT - I	INTRODUCTION	9

Probability Theory, Decision Theory, Information Theory, Probability Distributions - Binary variables, Multinomial Variables, Gaussian Distribution, non-parametric methods - Linear basis function models, bias variance decomposition, Bayesian Linear Regression.

UNIT - II	MACHINE LEARNING FOR ELECTRIC DRIVES	9

Model based fault diagnostic system driven by machine learning - 3-Phase Electric Drive Model - six switch inverter - Signal Analysis - Signal segmentation and feature extraction - Smart selections of operation parameters - Control point select algorithm - Multi-class Fault Classification using Artificial Neural Networks - Case Study using machine learning techniques.

UNIT - III	MACHINE LEARNING FOR POWER QUALITY MONITORING	9

Monitoring and diagnostic techniques for various power quality problems - power line disturbance analyser - quality measurement equipment - harmonic / spectrum analyser - flicker meters - disturbance analyser - AI based PQ meter-- AI based PQ classifier.

UNIT - IV	PREDICTIVE MAINTENANCE STRATEGY	9

Machine Learning Methods for Predictive Maintenance: Generalized Linear Model - Ensemble Learning - Deep Learning - Super Learning - Predictive Maintenance of Equipment with Tool Sensor and Process Data - Predictive Maintenance for Renewable Energy.

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UNIT - V	MACHINE LEARNING IN POWER SYSTEM CONTROL	9
On-line, real-time dynamic security assessment (DSA) - Preventive and corrective control - Fault detection - OPF approximation and speed up OPF solution - Outage management - Asset management Customer modelling and engagement - Demand response - Cyber security.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply probability theory for machine learning applications and solve regression problems.
CO2	Apply their knowledge of basic concepts of Electrical Drives using machine learning algorithms.
CO3	Analyze the power quality issues using the Power quality indices.
CO4	Apply proper predictive maintenance strategy.
CO5	Apply Machine Learning for proper decision making for analysis and control of power system.

Text Books	
1.	Kevin P. Murphy, “Machine Learning, probabilistic Perspective”, MIT Press, 2012.
2.	P. C. Krause, O. Wasynczuk and S. D. Sudhoff, “Analysis of Electric Machinery and Drive Systems”, John Wiley & Sons, 2013.
3.	J. Arrillaga, N.R. Watson, S. Chen, “Power System Quality Assessment”, Wiley, 2011.

Reference Books	
1.	Arindam Ghosh, Gerard Ledwich, “Power Quality Enhancement Using Custom Power Devices”, Springer Science, 2012
2.	Ethem Alpaydın , Introduction to Machine Learning , The MIT Press, 2010.
3.	D. Ernst, M. Glavicand L. Wehenkel, "Power systems stability control: reinforcement learning framework," in IEEE Transactions on Power Systems, vol. 19, no. 1, pp. 427- 435, Feb. 2004.
4.	Allen J. Wood, Bruce F, Wollenberg, Power generation operation and control, Second Edition, 1996.

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Professional Elective - V

B.E.	B19EEE705 - ELECTRIC VECHILE	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To study the fundamental concepts of Electric and conventional Vehicle.
2.	To study the Basic concept of electric traction and propulsion.
3.	To provide knowledge about electric components used in electric vehicles.
4.	To emphasize the energy storage requirements for electric vehicle.
5.	To study the energy management and charging strategies used in electric vehicles.

UNIT - I	INTRODUCTION TO ELECTRIC VEHICLES	9
History of hybrid and electric vehicles - social and environmental importance of electric vehicles - impact of modern drive - trains on energy supplies Conventional Vehicles (QA) - Basics of vehicle performance - vehicle power source characterization, - transmission characteristics.		

UNIT - II	ELECTRIC DRIVE TRAIN AND PROPULSION UNIT	9
Introduction to electric components - basic concept of electric traction - various drive-train topologies - configuration and control of various motor drives - DC Motor - Induction Motor Permanent Magnet Motor - Switch Reluctance Motor - power flow control topologies - fuel - efficiency analysis.		

UNIT - III	ENERGY STORAGE	9
Introduction to Energy Storage Requirements in Electric Vehicles - Energy storage-Battery - Fuel Cell - Super, - Flywheel - Design of a Battery Hybridization of different energy storage devices.		

UNIT - IV	ENERGY MANAGEMENT STRATEGIES	9
Introduction to energy management - classification-comparison - implementation issues of energy management strategies. Case Studies - Design of a Electric Vehicle (EV).		

UNIT - V	CHARGING STATION	9
Introduction - classification-on grid - off grid- fast charging - comparison - implementation issues and management policy - Standard Operating Procedures. Case Studies - Design of a Electric charging Station.		
		Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Outline the fundamental concepts of Electric and conventional Vehicle.
CO2	Explain basic concept of electric traction and propulsion.
CO3	Interpret knowledge about electric components used in electric vehicles.
CO4	Explain the energy storage requirements for electric vehicle.
CO5	Explain the energy management and charging strategies used in electric vehicles.

Text Books	
1.	Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2.	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3.	James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books	
1.	Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons Ltd. , 2011
2.	Emadi, A. (Ed.), Miller, J., Ehsani, M., “Vehicular Electric Power Systems” Boca Raton, CRC Press, 2003.
3.	Larminie, James, and John Lowry, “Electric Vehicle Technology Explained” John Wiley and Sons, 2012.
4.	Tariq Muneer and Irene Illescas García, “The automobile, In Electric Vehicles: Prospects and Challenges”, Elsevier, 2017.
5.	Sheldon S. Williamson, “Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles”, Springer, 2013.

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B.E.	B19EEE706 - INDUSTRIAL POWER SYSTEM ANALYSIS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To analyze the motor starting and power factor correction.
2.	To perform computer-aided harmonic and flicker analysis and to design filters.
3.	To expose various grid grounding methodologies.
4.	To Illustrate flicker analysis and to minimize the effect of it.
5.	To illustrate the concept of insulation coordination & minimize the effect of transient by the help of EMTP.

UNIT - I	MOTOR STARTING STUDIES	9

Introduction - Evaluation Criteria - Starting Methods - System Data - Voltage Drop Calculations - Calculation of Acceleration time - Motor Starting with Limited - Capacity Generators - Computer - Aided Analysis - Conclusions.

UNIT - II	POWER FACTOR CORRECTION STUDIES	9

Introduction - System Description and Modelling - Acceptance Criteria - Frequency Scan Analysis - Voltage Magnification Analysis - Sustained Overvoltage - Switching Surge Analysis - Back - to - Back Switching - Summary and Conclusions.

UNIT - III	HARMONIC ANALYSIS	9

Harmonic Sources - System Response to Harmonics - System Model for Computer - Aided Analysis - Acceptance Criteria - Harmonic Filters - Harmonic Evaluation - Case Study Summary and Conclusions.

UNIT - IV	FLICKER ANALYSIS	9

Sources of Flicker - Flicker Analysis - Flicker Criteria - Data for Flicker analysis - Case Study - Arc Furnace Load - Minimizing the Flicker Effects - Summary.

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UNIT - V	INSULATION AND COORDINATION	9
Modelling of system; simulation of switching surges; description of EMTP - capabilities; Voltage acceptance criteria; insulation coordination case study; methods of minimizing Switching transients; conclusions.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the motor starting techniques & design factors of it.
CO2	Develop and compare the different types of power factor corrective methods.
CO3	Explain the computer-aided harmonic analysis & filter.
CO4	Illustrate flicker analysis and to minimize the effect of it.
CO5	Illustrate the concept of insulation coordination & minimize the effect of transient by the help of EMTP.

Text Books	
1.	Ramasamy Natarajan, “Computer - Aided Power System Analysis”, Marcel Dekker Inc., 2002.
2.	Sen, S.K. “Principles of Electrical machine Designs with Computer Programmes.” Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987

Reference Books	
1.	George L. Kusic, “Computer-Aided Power System Analysis”, CRC press, 2018.
2.	A. Shanmugasundara, G. Gangadharan, R. Palani “Electrical machine Design Date Book” New Age International Pvt. Ltd., Reprint 2007.
3.	EMTP literature from www.microtran.cm

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B.E.	B19EEE707 - MICROCONTROLLER BASED SYSTEM DESIGN	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To learn about the architecture,interrupts and instruction set of AVR microcontroller.
2.	To understand the basic concepts of AVR interfacing.
3.	To know about the basics of ARM processor.
4.	To learn about the organization of ARM processor.
5.	To understand the basic concepts of ARM interfacing.

UNIT - I	INTRODUCTION TO AVR MICROCONTROLLER	9

Architecture - memory - Port System - Peripheral features - Timing Subsystems - Pulse width modulation channels - serial communications - Analog to digital converters - Interrupts - addressing modes - Instruction Set.

UNIT - II	AVR OPERATING PARAMETERS AND INTERFACING	9

Operating parameters - Input devices - Switches - Keypad - Sensors - Output devices - Seven segment LED Display - Tristate LED indicator - DOT matrix display - Liquid Crystal Display - DC motor speed and direction control - Interfacing to buzzers - vibrating motors.

UNIT - III	INTRODUCTION TO ARM PROCESSOR	9

Architecture - ARM programmer's model - ARM Development tools - ARM Assembly Language Programming - ARM Instruction Set - Simple Examples.

UNIT - IV	ARM ORGANIZATION	9

Stage Pipeline ARM Organization - 5 Stage Pipeline ARM Organization - ARM Instruction Execution - ARM Implementation - ARM Coprocessor interface - Thumb Instruction set - ARM Processor Cores - Memory Hierarchy.

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UNIT - V	ARM ARCHITECTURAL SUPPORT AND INTERFACING	9
Architectural Support for High Level Languages , system development, Operating systems - ARM CPU Cores - Memory interfacing - Keyboard interfacing - LCD interfacing - Embedded ARM Applications.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Outline the architecture,peripherals and interrupts of AVR microcontroller.
CO2	Apply the concepts of interfacing using AVR.
CO3	Illustrate the architecture, Interrupts and Instruction sets of ARM Processor.
CO4	Demonstrate the organization of ARM Processor.
CO5	Apply the concepts of architectural supports and interfacing using ARM.

Text Books	
1.	Steven F. Barrett, Daniel J. Pack ” Atmel AVR Microcontroller Primer: Programming and Interfacing” Morgan and Claypool publishers' series, 2012.
2.	Furber, S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2001.

Reference Books	
1.	Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Janice Mazidi, “ARM Assembly Language: Programming and Architecture”, Micro Digital Ed, 2017.
2.	Sarmad Naimi, Muhammad Ali Mazidi, Sepehr Naimi, “The Avr Microcontroller and Embedded Systems Using Assembly and C”, Micro Digital Ed, 2017.
3.	Stephen Bo Furber, “ARM System-on-chip Architecture”, Addison Wesley, 2000.

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B.E.	B19EEE708 - DEREGULATION OF ELECTRICAL ENERGY SYSTEM	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the restructuring process in power market.
2.	To analyse the concepts and terminologies used in power pool.
3.	To understand the Indian power system, issues, regulatory and acts.
4.	To analyse the available transfer capability & congestion management in restructured environment.
5.	To analyse the Indian power market restructured environment.

UNIT - I	POWER SYSTEM RESTRUCTURING: AN OVERVIEW	9
Introduction - Motivation for Restructuring of Power System - Electricity Market Entities and Model - Milestones of Deregulation - International Scenario - Industrialized countries - In the US - The Scene in Europe - The British power pool - Nordic Deregulation process - Developing countries - Benefits of deregulation - Basic Terminologies.		

UNIT - II	POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT	9
Introduction - Role of Independent system operator - Structure of UK and Nordic Electricity sector market operations - power pools - explanation of single auction power pool and double auction power pool with supply bid and demand - Two bus power system - four utility joint dispatch - Transmission networks and bilateral Electricity markets - bilateral trading in a two bus power system - three bus power system with feasible transactions.		

UNIT - III	TRANSMISSION OPEN ACCESS AND PRICING ISSUES	9
Introduction - power wheeling - Transmission open access - Types of Transmission services in open access - cost components in transmission - Pricing of power transactions - Embedded cost based Transmission pricing - Postage stamp method - contract path method - MW Mile method - Marginal participation method - Incremental cost based transmission pricing - SRMC and LRMC based pricing.		

UNIT - IV	AVAILABLE TRANSFER CAPABILITY AND CONGESTION MANAGEMENT	9
Introduction - Definition - Methods of Static ATC Determination - Method based on multiple load flow and continuation power flow - Method based on optimization power flow - method based on linear sensitivity factors. Congestion management - congestion management methods: An overview: Cluster / zone based method - Rescheduling of generation - LMP based congestion management.		

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UNIT - V	INDIAN POWER MARKET	9
Introduction - Indian power sector past and present status - growth of power sector in India - overview - Time line of Indian power sector - Players in the Indian power sector - Availability based tariff - Necessity - working mechanism - Beneficiaries - Day Scheduling process - Deviation from Schedule - unscheduled interchange rate - system marginal rate - trading surplus generation - applications.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the restructuring process, new entities in power market and benefits.
CO2	Apply the concepts and terminologies used in interchange evaluation, power pools and transaction issues.
CO3	Explain the Indian power system, issues, regulatory and policy developments and acts.
CO4	Demonstrate the transmission open access, congestion management and pricing issues.
CO5	Apply the available transfer capability in restructured environment.

Text Books	
1.	Kankar Bhattacharya Maath H.J. Bollen and Jaap E. Daalder, Operation of restructured power systems, Kluwer academic publishers, USA, first edition, 2001.
2.	P. Venkatesh, B.V. Manikandan, S. Charles Raja and A. Srinivasan, — Electrical power systems analysis, Security and Deregulation, PHI 2012.

Reference Books	
1.	Daniel Kirschen and Goran Strbac, Fundamentals of power system economics, John Wiley sons, 2004.
2.	Loi Lei Lai, Power system Restructuring and regulation John Wiley sons, 2001.
3.	M. Shahidepour, Hatim Tamin and Zuyi Li, Market operations in electric power system forecasting, scheduling and risk management, John Wiley sons, 2002.

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B.E.	B19EEE709 - OPTIMIZATION TECHNIQUES	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To learn the basic concepts of engineering optimization.
2.	To understand the genetic algorithm concepts.
3.	To learn the PSO algorithm concepts.
4.	To understand the different hybrid control schemes and algorithm concepts.
5.	To summarize optimization techniques.

UNIT - I	FUNDAMENTALS OF OPTIMIZATION	9

Definition - Classification of optimization problems - Unconstrained and Constrained optimization - Optimality conditions - Classical Optimization techniques (Linear and non-linear programming, Quadratic programming, Mixed integer programming) - Intelligent Search methods - Genetic Algorithm, Ant Colony Optimization - Tabu search, Particle swarm optimization.

UNIT - II	GENETIC ALGORITHM	9

Evolution in nature - Fundamentals of Evolutionary and Genetic algorithms - Working Principles of Genetic Algorithm - Genetic Operators - Selection, Crossover and Mutation - Issues in GA Implementation - Applications of GA in engineering optimization problems.

UNIT - III	PARTICLE SWARM OPTIMIZATION	9

Fundamental principle - Velocity Updating - Advanced operators - Parameter selection - Hybrid approaches (Hybrid of GA and PSO) - Implementation issues - Convergence issues - Applications of PSO in Engineering optimization problems.

UNIT - IV	NATURE INSPIRED METHODS	9

Simulated annealing algorithm - Differential Evolution - ant colony optimization - Bacteria Foraging Optimization - Firefly algorithm.

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UNIT - V	MULTI OBJECTIVE OPTIMIZATION	9
Concept of pareto optimality - Conventional approaches for MOOP - Multi objective GA - Fitness assignment - Sharing function - MOGA - Multiobjective PSO (dynamic neighbourhood PSO, Vector evaluated PSO) - Multi objective OPF problem.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Classify the knowledge on optimization techniques applied to power system problems.
CO2	Explain the different evolutionary computation techniques and engineering optimization problems.
CO3	Explain the concepts and control aspects of PSO.
CO4	Relate the concepts of nature inspired methods.
CO5	Summarize the multiobjective optimization and their applications.

Text Books	
1.	Xin - She Yang, "Optimization Techniques and Applications with Examples", John Wiley & Sons, Inc., 2018.
2.	S.P. Kothari and J.S. Dhillon,"Power System Optimization", 2nd Edition, PHI Learning Private Limited, 2010.
3.	Kalyanmoy Deb,"Multi objective optimization using Evolutionary Algorithms", John Wiley and Sons, 2008.
4.	Kalyanmoy Deb,"Optimization for Engineering Design", Prentice Hall of India First Edition,1988.

Reference Books	
1.	Carlos A.Coello Coello, Gary B.Lamont, David A.Van Veldhuizen," Evolutionary Algorithms for solving Multi Objective Problems", 2nd Edition, Springer, 2007.
2.	Soliman Abdel Hady, Abdel Aal Hassan Mantawy, "Modern optimization techniques with applications in Electric Power Systems", Springer, 2012.
3.	Jizhong Zhu, "Optimization of Power System Operation", John Wiley and sons Inc Publication, 2009.
4.	Kwang Y. Lee, Mohammed A.El Sharkawi, "Modern heuristic optimization techniques", John Wiley and Sons,2008.

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Open Elective - III

B.E. / B.TECH	B19AEO701 - UNMANNED AIRCRAFT SYSTEMS OPERATION AND MRO (Common to all Except AERO)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To apprehend the concepts of UAV and its types.
2.	To gain knowledge regarding the control and communications.
3.	To observe the aerodynamics performance and navigation operation.
4.	To know about the drone alignment maintenance.
5.	To recognize the safety take-off and landing and to manage failure factors.

UNIT - I	DRONE RULES & BASIC PRINCIPLES OF FLIGHT	9

International Rules - Regulations, Standards & Practices, Dos and Do not - Civil Aviation Requirements - AIPs, NOTAM, Classification & Categorization of drones - Type Certification of Drones - Registration - Sale & De-Registration of Drones - Operations of Drones - Dos and Don‟ts - Remote Pilot Licensing - Drone Insurance Fundamentals of flight - Aerodynamics - Take-off, flight, and landing - Maneuvers turns and circuit pattern.

UNIT - II	ATC PROCEDURES & RADIO TELEPHONY (NON FRTOL) WEATHER AND METEOROLOGY	9

Understanding ATC operations - Airspace structure and Airspace - Restrictions with knowledge of no drone zones - RT Phraseology & Communicating with ATC including Position and Altitude Reporting - Flight Planning Procedures including Altimeter setting procedures - Collision avoidance - Radio Telephony (RT) techniques - The standard atmosphere, Measuring air pressure, Heat and temperature, Wind - Moisture, cloud formation, icing and its effects - Effect of atmosphere on RPAS operation & hazardous weather avoidance - Met Terminal Aviation Routine Weather Report (METAR).

UNIT - III	FIXED - WING & ROTORCRAFT OPERATIONS AND AERODYNAMICS	9

Types of fixed wing drones, make, parts, terminology, Operation and maneuvers of fixed wing drones, Flight Performance. Intro to Mission Planning, Instrument Flying & Navigation (GCS) - Applications of fixed-wing UAVs. Pros and Cons of Fixed Wing Drones Rotorcraft- Basic drone terminology & parts, Types of drones, material used and size of drones, Drone Anatomy: Different parts of drones, Avionics & C2 Link, Intro to Mission Planning, Instrument Flying & Navigation (GCS). Applications and operations of Multirotor, Flight Performance. Pros and Cons of Rotorcraft Drones.

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UNIT - IV	HYBRID OPERATIONS, AERODYNAMICS & EQUIPMENT MAINTENANCE	9
Principles of Aerodynamics - Types of Hybrid Drones & Parts - Intro to Mission Planning - Instrument Flying & Navigation (GCS) - Applications of Hybrid UAVs - Comparison with Rotorcraft & Aero plane Drone Equipment Maintenance - Maintenance of drone - flight control box - ground station - Maintenance of ground equipment - batteries and payloads - Scheduled servicing, Repair of equipment, Fault finding and rectification.		

UNIT - V	SAFTY MANAGEMENT, PAYLOAD, & DATA & ANALYSIS	9
Drothe Emergency & Handling - Loss of C2-link - Fly-aways (Straying) - Loss of power, Other Emergencies, Control surface failures, Human Performance & Pilot Incapacitation - Fail - Safe Features - Types of payloads - What to carry , what not to carry - Parts of payloads - Installation - Features of payloads - Utilization, Principles of Observation, Elements of Image & Video Interpretation - Introduction to Photogrammetry - Types of Image & Video Data - Analysis.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Summarize the basic operations and principles of flight (K2)
CO2	Explain about the various avionics hardware operation and ATC procedure (K2)
CO3	Apply the aerodynamic principle on the airframe configuration (K3)
CO4	Examine the operations of the hybrid drones and maintenance of equipment (K4)
CO5	Determine the payload distribution and safety management procedure of the UAV (K5)

Text Books	
1.	Reg Austin “unmanned aircraft systems UAV design, development and deployment”, Wiley, 2010
2.	Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc,1998.
3.	Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007

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Reference Books	
1.	P.J.Swatton ―Ground studies for pilots„ flight planning‖, Sixth edition, 2002.
2.	Ian Heywood., "An Introduction to GIS", Pearson Education, New Delhi, 2001.
3.	Patel A.N & Surendra Singh, "Remote sensing principles & applications", Scientific Publishers, Jodhpur 1992.
4.	Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2000.
5.	Unmanned Aerial Vehicle (UAV) application for societal applications (https://www.cbinsights.com/research/drone-impact-society-uav/).

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B.E. / B.TECH	B19AGO701- PRODUCTION TECHNOLOGY FOR AGRICULTURAL MACHINERY (Common to all Except AGRI)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts of engineering materials
2.	To know the principles of machining and welding concepts
3.	To remember the farm mechanization and sowing implements
4.	To learn about the plant protection equipment
5.	To create knowledge on harvesting machinery

UNIT - I	ENGINEERING MATERIALS	9

Engineering materials - classification - Mechanical properties of materials, strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability. Steels and cast irons: Carbon steels, their classification - low, mild, medium & high carbon steel, their properties & applications. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.

UNIT - II	MACHINING AND WELDING	9

Basic principles of lathe - machine and operations - Basic description of machines and operations of Shaper - Planner, Drilling, Milling & Grinding - classification of welding processes. Gas welding, types of flames and their applications. Electric Arc welding. Resistance welding, Soldering & Brazing processes and their uses.

UNIT - III	TILLAGE AND SOWING IMPLEMENTS	9

Mould board plough - attachments - mould board shapes and types. Disc plough - force representation on disc - Types of disc ploughs - Subsoiler plough - Rotary plough - Chisel plough - Cultivators - types - construction. Disc harrows - Bund former - Rotavator - ridger - leveller. Basin lister - Wetland preparation implements - Crop Planting - methods - row crop planting systems - Devices for meeting seeds - furrow openers - furrow closers - types - Types of seed drills and planters - Seed cum fertilizer drills - paddy transplanters.

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UNIT - IV	WEEDING AND PLANT PROTECTION EQUIPMENT	9

Weeding equipment - hand hoe - long handled weeding tools - dryland star weeder - wetland conoweeder and rotary weeder - Engine operated and tractor weeders Sprayers - types - classification - methods of atomization, spray application rate, droplet size determination - volume median diameter, numerical median diameter - drift control.

UNIT - V	HARVESTING AND THRESHING MACHINERY	9

Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder, combine harvesters, balers, threshers, combine losses.

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand concepts of engineering materials and steel properties
CO2	Outline the different machining and welding process
CO3	Understand the different tillage and sowing implements
CO4	Illustrate the concepts of plant protection equipments.
CO5	Summarize the knowledge on harvesting mechanism

Text Books	
1.	"Manufacturing Engineering and Technology", Kalpakjian and Schmid, Pearson, 2010.
2.	Hajra Choudry, "Elements of workshop technology - Vol II", Media promoters, 2002.
3.	Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.,2010.
4.	Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005.

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Reference Books	
1.	Gupta. K.N., and Kaushik, J.P., 1998, Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi.
2.	Arthur. D., et. al. 1998, General Engineering Workshop Practice, Asia Publishing House, Bombay.
3.	Chapman W.A.J., Workshop Technology, 1992, Part I, II, III, E.L.B.S. and Edward Amold Publishers Ltd, London.
4.	Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.
5.	Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi.,1996.
6.	Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.
7.	https://nptel.ac.in/courses/126/105/126105009/

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B.E. / B.TECH	B19BMO701 - TELEMEDICINE (Common to all Except BME)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To gain the knowledge on the basic principles for telemedicine.
2.	To understand the legal aspects of telemedicine.
3.	To learn the key principles for telemedicine standards.
4.	To study the concepts for secure transmission of data.
5.	To know health education, mobile telemedicine and it applications.

UNIT - I	INTRODUCTION TO TELEMEDICINE	9

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Telehealth, Tele care, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine.

UNIT - II	ETHICAL, SECURITY AND LEGAL ASPECTS OF TELEMEDICINE	9

Confidentiality, patient rights and consent : confidentiality and the law, the patient - doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues, intellectual property rights, Security in Telemedicine systems - Access control, Fire wall, Encryption, Authentication, Digital certificate, Digital Timestamp.

UNIT - III	TELEMEDICINE STANDARDS	9

Principles of Multimedia - Text, Audio, Video, data, PSTN, POTS, ANT, ISDN, Internet, Wireless Communication - GSM satellite and Micro wave, Modulation techniques, Types of Antenna, Satellite communication, Mobile hand-held devices and mobile communication. Internet technology and telemedicine using worldwide, Video and audio conferencing.

UNIT - IV	DATA ACQUISTION AND STORAGE SYSTEM	9

Acquisition System - Camera, Scanners, Display Systems - Analogue Devices, LCD, Laser Displays, Holographic Representation, Virtual Screen devices, Storage System - Magnetic System, Optical System, Solid State Disk.

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UNIT - V	APPLICATIONS OF TELEMEDICINE	9
Telemedicine access to health care services, health education and self-care. Introduction to robotics surgery, telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability.		
		Total Instructional hours : 45

Course Outcomes : At the end of the course, the student should be able to	
CO1	Recall the basic concepts of telemedicine and health
CO2	Interpret the legal aspects of Telemedicine
CO3	Explain telemedicine standards in communication
CO4	Make use of data acquisition and storage.
CO5	Illustrate about the medical applications and usage of telemedicine

Text Books	
1.	Norris, A.C. "Essentials of Telemedicine and Telecare", Wiley, 2002.
2.	Wootton, R., Craig, J., Patterson, V. (Eds.), "Introduction to Telemedicine. Royal Society of Medicine" Press Ltd., Taylor & Francis 2006.
3.	O'Carroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), "Public Health Informatics and information Systems", Springer, 2003.

Reference Books	
1.	Ferrer - Roca, O., Sosa - Iudicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2002.
2.	Simpson, W. Video over IP. A practical guide to technology and applications. Focal Press Elsevier, 2006.
3.	Mohan Bansal, "Medical Informatics", Tata McGraw-Hill, 2004.

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B.E. / B.TECH	B19BTO701 - FUNDAMENTALS OF NANOTECHNOLOGY (Common to all Except BT)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of nanomaterials and their characteristics.
2.	To gain knowledge on the relationship between nano and biosystems.
3.	To acquire information on nanobiocomposites.
4.	To enhance skill and knowledge on analysis of nanomaterials and
5.	To apply the knowledge and skills of nanotechnology in medicine and related fields.

UNIT - I	INTRODUCTION TO NANOTECHNOLOGY	9
Definition- history of nanomaterials- classification of nanomaterials, Properties of nanomaterials - concept of nanoscale engineering - size and confinement effects.		

UNIT - II	SYNTHESIS AND CHARACTERIZATION OF NANOPARTICLES	9
Strategies for nano architecture, bottom-up, top down and functional approaches; Chemical and physical synthesis of nanoparticles - characteristics of nanoparticles; Characterization of nanoscale materials using UV spectroscopy, TEM, AFM/STM, XRD and FTIR.		

UNIT - III	INTERLINKING BIOLOGY WITH NANOTECHNOLOGY	9
Bionanomaterials - DNA, protein and lipids based nanostructures- synthesis, characterization and applications; Bionanopores-Biological synthesis of nanoparticles - bacteria, fungi, yeast and plants-mechanism; Molecular Self-assembly in biology.		

UNIT - IV	BIOLOGICAL FUNCTIONALISATION OF NANOMATERIALS	9
DNA / protein - gold nanoparticle conjugates; DNA nanostructures for mechanics and computing; DNA as smart glue - DNA analyser as biochips; Biologically inspired nanocomposites; Peptide nanostructures and their applications - electronics, antibacterial agents.		

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UNIT - V	APPLICATION OF NANOBIOTECHNOLOGY	9
Antimicrobial activity of nanoparticles and its mechanism; Nanoanalytics - Quantum dots - Bioconjugates in cell and tissue imaging; Diagnosis of cancer and other diseases using bionanosystems; Drug and gene delivery; Protein targeting- targeting signals, translocation and sorting; Micelles for drug delivery; Proteins and DNA coupled nanoparticles for biosensors; Nanotechnology in agriculture.		
		Total Instructional hours : 45

Course Outcomes : At the end of the course student will be able to	
CO1	Understand the fundamentals of nanoscience and technology.
CO2	Explain synthesis and characterization of nanoparticles.
CO3	Understand the potential applications of bionanomaterials in various fields.
CO4	Understand the design and development of health related nanomaterials.
CO5	Apply bionanomaterials in various fields.

Text Books	
1.	Rao CNR, A Muller and AK Cheetham, “The Chemistry of Nanomaterials - Synthesis, Properties and Applications”, John Wiley & Sons, 2006.
2.	Pradeep T, “Nano: The Essentials”, Tata McGraw Hill, New Delhi, 2007.
3.	Niemeyer CM, and CA Mirkin, “Nanobiotechnology: Concepts, Applications and perspectives”, John Wiley & Sons, 2004.

Reference Books	
1.	Nicolini C, “Nanobiotechnology and Nanobiosciences”, Pan Stanford Publishing Pvt. Ltd, 2009.
2.	Goodsell SD, “Bionanotechnology - Lessons from Nature”, Wiley-Liss, Inc, 2004.
3.	Bhushan B, “Handbook of Nanotechnology”, Springer, Heidelberg, 2006.

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B.E. / B.TECH	B19CSO701 - FUNDAMENTAL OF CLOUD COMPUTING (Common to all Except CSE, AI & DS, CSBS)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic concepts of Computer Networks and Cloud Computing.
2.	To understand the broad perceptive design of cloud architecture and model.
3.	To study the concept of Virtualization and design of cloud Services
4.	To be familiar with the storing data in cloud and secure to data in cloud.
5.	To apply different cloud programming model as per need and design the trusted cloud Computing system.

UNIT - I	CLOUD COMPUTING FUNDAMENTALS	9

Introduction to computer networks - evolution of computer networks and its uses - Types of Networks - Advantages and Disadvantages of Computer Network - Introduction to Cloud Computing - Essential characteristics, Underlying Principles of Parallel and Distributed Computing - Cloud Characteristics - Elasticity in Cloud - On-demand Provisioning.

UNIT - II	CLOUD ARCHITECTURE AND MODELS	9

NIST Cloud Computing Reference Architecture - Cloud Models: Characteristics - Cloud Services - IaaS, PaaS, SaaS - Public vs Private Cloud - Cloud Solutions - Cloud ecosystem - Service management - Computing on demand.

UNIT - III	CLOUD VIRTUALIZATION	9

Basics of Virtualization - Types of Virtualizations - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management - Virtualization for Data - Center Automation.

UNIT - IV	CLOUD COMPUTING STORAGES AND SECURITY	9

Cloud Storage - Storage-as-a-Service - Advantages of Cloud Storage - Cloud Storage Providers - S3 - Security Overview - Cloud Security Challenges - Software-as-a-Service Security - Security Governance - Virtual Machine Security - IAM - Security Standards.

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UNIT - V	CLOUD TECHNOLOGIES AND ADVANCEMENTS	9
Hadoop - MapReduce - Virtual Box -- Google App Engine - Programming Environment for Google App Engine - Open Stack - Federation in the Cloud - Four Levels of Federation - Federated Services and Applications - Future of Federation.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Compare the strengths and limitations of cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Outline various virtualization concepts.
CO4	Summarize the core issues of cloud such as storage, security, and privacy.
CO5	Show Cloud Services with appropriate tools.

Text Books	
1.	Curtis Franklin, Jr. ,Brian J.S. Chee, “Securing the Cloud: Security Strategies for the Ubiquitous Data Center”, CRC Press, 2019.
2.	Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security ‖, CRC Press, 2017.

Reference Books	
1.	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, TMH, 2013.
2.	Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.

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B.E. / B.TECH	B19ECO701 - INTRODUCTION TO COMMUNICATION SYSTEMS (Common to all Except ECE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the concept of basic Analog and Digital Communication Systems.
2.	To understand the various modulation techniques for Analog and digital communication Systems.
3.	To perform a block-diagram design of the transmitter and receiver for a basic Analog and Digital Communications System.
4.	To identify the performance, in terms of bit error rate, of a Digital Communication System.
5.	To study the wireless channel and Mobile Communication Systems.

UNIT - I	ANALOG COMMUNICATIONS	9

Basic concepts of Linear Modulation and Demodulation - Modulation Index - Power relation in AM wave - double and single sideband - Generation and Detection of Amplitude Modulation - Hilbert transform -analytic signal.

UNIT - II	ANGLE MODULATIONS	9

Frequency Modulation-comparison of frequency modulation and amplitude modulation - narrowband and wideband FM - Bessel functions - Carson's rule - bandwidth - Generation and Demodulation of frequency and phase modulation - Phase-locked loops.

UNIT - III	DIGITAL COMMUNICATIONS	9

Nyquist sampling theorem - Pulse amplitude modulation, Pulse code modulation - quantization noise, delta modulation, DPCM, ADPCM, Multiplexing and Multiple Access Techniques - FDM and FDMA, TDM and TDMA, CDMA.

UNIT - IV	DIGITAL MODULATION TECHNIQUES	9

Binary Phase Shift Keying - Binary Frequency Shift Keying - Pulse Amplitude Modulation (PAM), On - Off Keying OOK. Optimum receiver structures for digital communication - matched filtering, co-relation detection, probability of error.

R. Gowri

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UNIT - V	WIRELESS CHANNEL AND MOBILE COMMUNICATION	9
Overview of wireless systems - capacity of wireless channel - Examples of Wireless Communication Systems - Paging system, Cordless telephones systems, Cellular telephone Systems - Cellular concept - Large and small Scale Fading.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the basic concepts of Analog Communication Systems.
CO2	Use of Angle Modulation techniques for Analog Communication.
CO3	Identify and describe different techniques in modern Digital Communications.
CO4	Explore various Digital Modulation Techniques.
CO5	Analyse the performance of wireless channels for Mobile Communication.

Text Books	
1.	Thepdore. S. Rapport, "Wireless Communications: principles and practice", 2^{nd} Eidtion, pearson education, india, 2009.
2.	B.P. Lathi, "Modern Digital and Analog Communication systems", 4^{th} Edition, Oxford university press, 2010.
3.	S. Haykin , " Communication systems", 3/e John Wiley, 2007.

Reference Books	
1.	David Tse and Pramod Viswanath, " Fundamentals of wireless communications" Wiley series in Telecommunications, cambridge university press, 2005.
2.	J.G.Proakis, M.Salehi, " Fundamentals of Communication Systems" - Pearson education 2006.
3.	H. P. Hsu, Schaum outline series, "Analog and Digital Communications" , TMH, 2006.
4.	Andrea Goldsmith, " Wireless Communications", Cambridge University Press, 2005.

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B.E. / B.TECH	B19MEO701 - 3D PRINTING AND TOOLING (Common to all Except MECH)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To explore the technology used in additive manufacturing.
2.	To develop CAD models for 3D printing.
3.	To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
4.	To select a 3D printing process for an application.
5.	To produce a product using 3D Printing or Additive Manufacturing (AM).

UNIT - I	INTRODUCTION TO ADDITIVE MANUFACTURING (AM)	9
Overview - History - Need - classification - Additive Manufacturing Technology in product development - Materials for Additive Manufacturing.		

UNIT - II	CAD AND REVERSE ENGINEERING	9
Basic concept - 3D scanning - digitization techniques - Model reconstruction - data processing for reverse engineering - Additive Manufacturing Technology: CAD model preparation - Part orientation and support generation - Model slicing - Tool path generation.		

UNIT - III	LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING	9
Classification - liquid based system - stereo lithography apparatus (SLA) - principle, process, advantages and applications - solid based system - Fused Deposition Modeling - principle, process, advantages.		

UNIT - IV	LASER BASED ADDITIVE MANUFACTURING SYSTEMS	9
Selective laser sintering - principles of SLS process - process, advantages and applications, 3D Printing-principle, process, advantages - Laser Engineered Net Shaping (LENS).		

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UNIT - V	RAPID TOOLING AND APPLICATIONS OF ADDITIVE MANUFACTURING	9
Principles and typical process for quick batch production of plastic and metal parts through quick tooling - applications for Aerospace, defence, automobile, Bio-medical and general engineering industries		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the importance of Additive Manufacturing.
CO2	Apply technique of CAD and reverse engineering for geometry transformation in Additive Manufacturing.
CO3	Define the various process used in Additive Manufacturing.
CO4	Identify and select suitable process used in Additive Manufacturing.
CO5	Understand the basic concept of quick tooling and additive manufacturing application

Text Books	
1.	Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2.	Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
3.	Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.

Reference Books	
1.	J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.
2.	Dougles Bryden, "CAD and Prototyping for Product Design", 2014.
3.	C.K. Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping - Principles and Applications", World Scientific, 2017.

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Semester - VIII

Professional Elective - VI

B.E.	B19EEE801 - UTILIZATION AND CONSERVATION OF ELECTRIC ENERGY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the principle, design of illumination systems and energy efficiency lamps.
2.	To understand the electric traction systems and their performance.
3.	To study the methods of industrial heating and welding.
4.	To know about house wiring connection and working of domestic electrical appliances.
5.	To study the Energy conservation methods of electrical equipment.

UNIT - I	ILLUMINATION	9

Introduction, Terms used in illumination, laws of illumination, photometry - types of lamps - lighting schemes, Design of lighting schemes for different applications. Factors to evaluate lighting design, energy efficient lamps.

UNIT - II	ELECTRICTRACTION	9

Introduction - requirements of electric traction system - supply systems for track electrification -mechanics of train movement - traction motors and control - braking - current collection systems - recent trends in electrictraction.

UNIT - III	HEATING AND WELDING	9

Role of electric heating for industrial applications - resistance heating - induction heating - dielectric heating - design of heating elements - electric arc furnaces. Types of welding, resistance and arc welding, electric welding equipment and its characteristics - comparison between A.C and D.C Welding.

UNIT - IV	DOMESTIC UTILIZATION OF ELECTRICAL ENERGY	9

Domestic utilization of electrical energy - House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects - nonlinear and domestic loads - Earthing - Domestic, Industrial and Substation.

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UNIT - V	CONSERVATION OF ELECTRICAL ENERGY	9
Introduction to Energy conservation - Energy conservation Act 2001 and its features - Energy Conservation in motors - Pumps - Fans and Compressors - Refrigeration and HVAC system, operation and maintenance practices for electrical energy conservation - Tools for Energy auditing.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Design lighting schemes to various applications based on the specific lighting level standards.
CO2	Outline about the electric traction systems and their performance.
CO3	Identify an appropriate method of heating and welding process for specified applications.
CO4	Construct a domestic wiring and able to identify different types of UPS and Battery for a specific application.
CO5	Analyze the energy conservation methods of various electrical equipment.

Text Books	
1.	C.L. Wadhwa, ‘Generation, Distribution and Utilization of Electrical Energy’, 3rd/e, New Age International Pvt. Ltd, 2012.
2.	J.B. Gupta, ‘Utilization of Electric Power and Electric Traction’, S.K.Kataria and Sons, second edition, 2012.
3.	Bureau & Energy Efficiency, "Energy Efficiency in Electrical Utilities", Guide Book for National Certification Examination for Energy Managers and Energy Auditors, New Delhi, 2013. (www. bee - india.nic.in)

Reference Books	
1.	R.K.Rajput, "Utilisation of Electrical Power", Laxmi publications (P)Ltd.,2nd Edition, 2016.
2.	Partab.H, “Art and Science of Utilisation of Electrical Energy”, DhanpatRai and Co, New Delhi, 2014.
3.	Sivanagaraju s et al., Generation and Utilization of Electrical Energy, Pearson Education India, 2010.
4.	OpenshawTaylor.E, “Utilization of Electrical Energy in SI Units”, Orient Longman Pvt. Ltd,2003.
5.	Cleaner Production - Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

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B.E.	B19EEE802 - INDUSTRIAL COMMUNICATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts of industrial networking protocol.
2.	To study the basics of Industrial Ethernet for industrial automation.
3.	To learn about Industrial network safety.
4.	To know about the Wireless Industrial networks.
5.	To learn about the Automative Communication technologies.

UNIT - I	INDUSTRIAL NETWORK PROTOCOLS	9

Networked control system for manufacturing - configuration and management of networked embedded devices - Smart Transducer Interface Standard for Sensors and Actuators - IO Link for Sensors - AS interface - Common industrial protocol - HART Field Communications - HART Communication - HART System - HART Protocol - HART Integration.

UNIT - II	INDUSTRIAL ETHERNET	9

Foundation fieldbus network - MODBUS protocol - PROFIBUS - PROFINET - Sercos Automation Bus - INTERBUS - Concept of LAN - Ethernet LAN - Ethernet frame structure - Ethernet (IEEE 802.3) - switched Ethernet in automation - Real time Ethernet for automation applications - Ethernet for control automation technology - Ethernet POWERLINK- linking factory floor and Internet.

UNIT - III	INDUSTRIAL NETWORK SAFETY	9

Safety Integrity Level (SIL) - SIL Methods - SIL Policies - PROFIsafe - safety NET protocol - Security in industrial communication - security controls and security countermeasures - Industrial control systems - Intrusion detection in industrial network - common and advanced industrial security recommendations - Industrial cyber security.

UNIT - IV	WIRELESS INDUSTRIAL NETWORKS	9

Wireless LAN technology for factory floor - wireless HART - ISA100.11a - comparison of wireless HART and ISA100.11a for wireless instrumentation - IEC 6201 - wireless network for industrial automation - process automation (WIA-PA) - wireless extension of real time industrial networks - wireless sensor network for automation.

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UNIT - V	AUTOMATIVE COMMUNICATION TECHNOLOGIES	9
Protocol and services in Controller Area Network - FlexRay Communication technology - LIN standard - standard protocol for home and Building automation - protocol for automatic meter reading - communication protocols for power system automation - fundamentals of IEC 61400-25 standard - Functional Safety Standards : IEC 61508.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the basic concepts of industrial networking protocol.
CO2	Illustrate the concepts of Ethernet for industrial automation.
CO3	Demonstrate the concepts of safety and security in industrial communication.
CO4	Make use of the concept of Wireless network for Industrialautomation.
CO5	Interpret the communication technologies and Standard Protocols.

Text Books	
1.	Richard Zurawski “The Industrial Communication Technology Handbook”, CRC press, 2015.
2.	Bogdan M. Wilamowski, J. David Irwin, “Industrial Communication Systems”, CRC press, 2011.
3.	Forouzen, “Data Communication and Networking”, McGraw Hill Education, 2017.
4.	Eric D. Knapp, Joel Thomas Langill, “Industrial Network Security” Syngress, 2015.

Reference Books	
1.	Deon Rynders, Steve Mackay, Edwin Wright, “Practical Industrial Data Communications Best Practice Techniques, Newnes, 2005.
2.	RaimondPigan, Mark Metter, Automating with PROFINET : Industrial Communication Based on Industrial Ethernet, Publicis Publishing 2008.
3.	FrithjofKlasen, Michael Volz, Volker Oestreich, “Industrial Communication with Fieldbus and Ethernet”, VDE-Verlag,2011.
4.	SwapanBasu, “Plant Hazard Analysis and Safety Instrumentation Systems”, Academic Press, 2017.

BoS Chairman

B.E.	B19EEE803 - FPGA BASED SYSTEM DESIGN	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand FPGA architecture, interconnect and technologies.
2.	To know different FPGAs and implementation methodologies.
3.	To discuss the basic concepts of Verilog HDL.
4.	To make use of Verilog HDL to describe Combinational and Sequential circuits.
5.	5.To explore the development and deployment of FPGA based digital systems.

UNIT - I	INTRODUCTION	9
Digital Design and FPGA - Role of FPGA - FPGA Types - FPGA Vs Custom VLSI - Goals and Techniques - Design Challenges - Design abstraction - Methodologies.		

UNIT - II	FPGA FABRICS	9
FPGA Architectures - SRAM Based FPGA - Permanently Programmed FPGAs - Chip I/O - Circuit Design of FPGA Fabrics - Architecture of FPGA Fabrics.		

UNIT - III	FPGA ARCHITECTURE DESIGN	9
Behavioral Design - Data path controller Architectures - Scheduling and Allocation - Power - Pipelining - Design Methodologies - Design Example - Digital Signal Processor.		

UNIT - IV	VERILOG HDL	9
Hardware Description Languages - Verilog Description - Modules - Assignment - Always block - Delays - Data Types and Operators - Behavioral and Structural Verilog - Constants - Arrays - Loops - Testing Verilog Program.		

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UNIT - V	VERILOG MODELING OF COMBINATIONAL AND SEQUENTIAL CIRCUITS	9
Behavioral, Data Flow and Structural Realization - Adders - Multipliers- Comparators - Flip Flops - Realization of Shift Register - Realization of a Counter- Single port and Dual port RAM - Pseudo Random LFSR - Cyclic Redundancy Check.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the types and methodologies for FPGA design.
CO2	Interpret FPGA architecture and able to interconnect the logic elements of FPGA for the given requirement.
CO3	Interpret data path controller architecture and design methodologies.
CO4	Make use of Verilog programming techniques to develop programs based on structural, behavioral and dataflow models.
CO5	Model combinational and sequential digital circuits by Verilog HDL.

Text Books	
1.	Wayne Wolf , "FPGA Based System Design" , Prentice Hall , Pearson Education, Inc. 2004.
2.	Charles Roth, Lizy K. John, ByeongKilLee , "Digital Systems Design Using Verilog", Global Engineering, 1st Edition, 2014.
3.	Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis” Prentice Hall, Second Edition, 2003.

Reference Books	
1.	Suman LataTripathi, Sobhit Saxena, Sanjeet K.Sinha, Govind S. Patel , “Digital VLSI Design and Simulation with Verilog”, Wiley Publishers, 2021.
2.	John. F. Wakerly , " Digital Design", Pearson Education, India, 2012.
3.	T.R. Padmanabhan, B.Bala Tripura Sundari, “Design through Verilog HDL”, Wiley India Pvt, Limited, 2008.
4.	Bob Zeidman, "Designing with FPGAs and CPLDs", CMP Books Publications, 2002.

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B.E.	B19EEE804 - TOTAL QUALITY MANAGEMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the concept of quality and Philosophies of Total Quality Management.
2.	To understand the TQM principles and concepts of continuous improvement.
3.	To acquire knowledge on quality tools, management tools and statistical fundamentals toimprove quality.
4.	Develop skills to use TQM tools for domain specific applications.
5.	To understand the quality systems and procedures.

UNIT - I	INTRODUCTION	9
Introduction - Need for quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM Implementation.		

UNIT - II	TQM PRINCIPLES	9
Customer satisfaction - Customer Perception of Quality, Customer complaints and Customer retention - Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen, Just-In-Time and TPS.		

UNIT - III	TQM TOOLS AND TECHNIQUES I	9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.		

UNIT - IV	TQM TOOLS AND TECHNIQUES II	9
Quality Circles - Cost of Quality - Quality Policy Deployment (QPD) - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.		

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UNIT - V	QUALITY SYSTEMS	9
Introduction - Benefits of ISO Registration - ISO 9000 Series of Standards - Sector - Specific Standards - AS 9100, TS16949 and TL 9000 - ISO 9001 Requirements-Implementation, Documentation, Internal Audits - ISO 14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001 - Benefits of Environmental Management System (EMS) - ISO 31000 Risk Management.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the concept of quality and Philosophies of Total Quality Management.
CO2	Apply TQM principles and concepts of continuous improvement.
CO3	Explain the quality tools, management tools and statistical fundamentals to improve quality.
CO4	Apply TQM tools and concept to improve quality.
CO5	Explain the quality systems and procedures for implementation.

Text Books	
1.	James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8^{th} Edition, First Indian Edition, Cengage Learning, 2012.
2.	Dale H.Besterfield et al, “Total Quality Management”, Third edition, Pearson Education - First Indian Reprints 2004.
3.	Shridhara Bhat K., Total Quality Management - Text and Cases, Himalaya Publishing House, First Edition 2002.

Reference Books	
1.	Narayana V. and Sreenivasan, N.S. “Quality Management - Concepts and Tasks”, New Age International 2007.
2.	Janakiraman. B and Gopal .R.K., “Total Quality Management - Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.

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B.E.	B19EEE805 - SMART GRID	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand about Smart Grid and Architecture.
2.	To explain SmartGridTechnologies and Distribution System.
3.	To explain Smart meters and Advanced metering infrastructure.
4.	To Illustrate the Power quality management issues in Smart Grid.
5.	To Illustrate the high performance computing for Smart Grid applications and Cyber Security.

UNIT - I	INTRODUCTION TO SMART GRID	9

Evolution of Electric Grid - Need for Smart Grid - Difference between conventional & smart grid - Overview of enabling technologies - International experience in Smart Grid deployment efforts - Smart Grid road map for India - Smart Grid Architecture.

UNIT - II	SMART GRID TECHNOLOGIES	9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt / VAR control, Fault Detection, Isolation and service restoration, Outage management, Plug in Hybrid Electric Vehicles (PHEV).

UNIT - III	SMART METERS	9

Introduction to Smart Meters - Features and functions of Smart Meters - Functional specification - category of Smart Meters - Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits - AMI protocol, Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT - IV	POWER QUALITY MANAGEMENT IN SMART GRID	9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditionersfor Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

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UNIT - V	SMART GRID APPLICATIONS AND CYBER SECURITY	9
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Powerline (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the concepts of Smart Grid and its present developments.
CO2	Illustrate the different Smart Gridt echnologies.
CO3	Illustrate the knowledge about different smart meters and advanced Metering infrastructure.
CO4	Explain the power quality management in Smart Grids.
CO5	Summarize more understanding on LAN, WAN and Cloud Computing for Smart Grid Applications.

Text Books	
1.	Stuart Borlase, “Smart Grids: Infrastructure, Technology and Solutions”, 1st Edition, CRC Press Publication, England, 2013.
2.	Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”,Wiley 2012.

Reference Books	
1.	Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.
2.	VehbiC. Güngör ,Dilan Sahin, TaskinKocak, SalihErgüt, ConcettinaBuccella, Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication Technologies and Standards” IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.
3.	Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “Smart Grid -The New and Improved Power Grid: A Survey”, IEEE Transaction on Smart Grids, Vol.14, 2012.

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Open Elective - IV

B.E. / B.TECH	B19AEO801 - VEHICLE AERODYNAMICS (Common to all Except AERO)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts of vehicle and its internal design.
2.	To know the principles of process, planning, and ventilation system.
3.	To know the different type of noises and acoustics.
4.	To learn about the ergonomics and occupant accommodation.
5.	To create knowledge on various control systems.

UNIT - I	INTRODUCTION TO VEHICLE DESIGN	9

Timeline developments in design - Mass production - Streamlining for style and low drag - Commercial vehicles - Engine developments - Transmission system development - Steering - Suspension - Brakes - Interior refinement - Safety design.

UNIT - II	VEHICLE BODY DESIGN	9

The styling process - Working environment and structure - Product planning - Concept sketching and package related sketching - Full sized tape drawing - Clay modelling - Aerodynamics - Aerodynamic forces - Drag & Drag reduction - Stability during cross - winds - Wind Noise - Under-hood ventilation - Cabin ventilation - Introduction to Computational fluid dynamics - Wind tunnel testing of scale models.

UNIT - III	NOISE AND VIBRATION	9

Vibration - fundamentals & control - Acoustics - fundamentals - Human response to sound - Sound measurement - Automotive noise criteria - Drive-by noise tests, Noise from stationary vehicles, Interior noise in vehicles, Automotive noise sources and control techniques - Engine noise, Transmission noise, Intake & exhaust noise, Aerodynamic noise, Tyre noise, Brake noise.

UNIT - IV	CRASHWORTHINESS AND ERGONOMIC APPROACH	9

Accident and injury analysis - Vehicle impacts: general dynamics & crush characteristics - Structural collapse and its influence upon safety - Occupant accommodation - Ergonomics in the automotive industry - Ergonomics methods and tools - Case studies of Fiat Punto - Strategies for improving occupant accommodation and comfort.

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UNIT - V	VEHICLE CONTROL SYSTEMS	9
Automotive application of sensors - Chassis control systems - Anti-lock braking systems, Traction control systems, Electronically controlled power - assisted steering - Vehicle safety and security systems - Air-bag and seat belt pre-tensioner systems, Remote keyless entry and vehicle immobilization, Introduction to On-board navigation systems.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Outline the periodical developments in design, production and various components of vehicle bodies.
CO2	Make use of sketching concept like tape drawing and clay modelling to reduce the aerodynamics drag on vehicle body.
CO3	Analyze the various automotive noise sources and its control techniques.
CO4	Evaluate the vehicle crash worthiness requirements for improving passengers and comfort.
CO5	List the different control system and sensors used in controlling the vehicle.

Text Books	
1.	An Introduction to Modern Vehicle Design, Julian Happian - Smith, Butterworth - Heinemann Ltd (2002)

Reference Books	
1.	Aerodynamics of Road Vehicles: From Fluid Mechanics to Vehicle Engineering. Wolf-Heinrich Hucho (Eds.), Butterworth-Heinemann Ltd (1987).
2.	Sensors and Transducers, Ian R Sinclair, Butterworth - Heinemann Ltd (2001).
3.	The Motor Vehicle - T.K. Garrett, K. Newton & W. Steeds, Butterworth- Heinemann Ltd (2001).

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B.E. / B.TECH	B19AGO801- AGRICULTURE FINANCE, BANKING AND COOPERATIVES (Common to all Except AGRI)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart knowledge on principles basic agriculture finance system.
2.	To understand the different farm financial analysis
3.	To acquire the knowledge on different functions of financial institutions
4.	To understand banking and cooperation for agricultural and agro based industries and financial system
5.	To know the functions of various institutions involved in farm financing crop insurance products.

UNIT - I	AGRICULTURAL FINANCE - NATURE AND SCOPE	9

Agricultural Finance: Definition, Importance, Nature and Scope - Agricultural Credit: Meaning, Definition, Need and Classification - Sources of credit - Role of institutional and non-Institutional agencies: Advantages and Disadvantages - Rural indebtedness: consequences of rural indebtedness - History and Development of rural credit in India.

UNIT - II	FARM FINANCIAL ANALYSIS	9

Principles of Credit - 5C's, 5R's and & 7P's of Credit - Project Cycle and Management - Preparation of bankable projects / Farm credit proposals - Feasibility - Time value of money: Compounding and Discounting - Appraisal of farm credit proposals - Undiscounted and discounted measures - Repayment plans - Farm Financial Statements: Balance Sheet, Income Statement and Cash Flow statement - Financial Ratio Analysis.

UNIT - III	FINANCIAL INSTITUTIONS	9

Institutional Lending Agencies - Commercial banks: Nationalization, Agricultural Development Branches - Area Approach - Priority Sector Lending - Regional Rural Banks, Lead bank, Scale of finance - Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India - Microfinance and its role in poverty alleviation - Self-Help Groups - Non -Governmental Organizations - Rural credit policies followed by State and Central Government - Subsidized farm credit, Differential Interest Rate (DIR), Kisan Credit Card (KCC) Scheme - Relief Measures and Loan Waiver Scheme and Know Your Customer (KYC).

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UNIT - IV	CO-OPERATION	9

Co-operation: Philosophy and Principles - History of Indian Cooperative Credit Movement: Pre and Post-Independence periods and Cooperation in different plan periods - Cooperative credit institutions: Two tier and three tier structure, Functions: provision of short term and long term credit, Strength and weakness of cooperative credit system, Policies for revitalizing cooperative credit: Salient features of Vaithiyananthan Committee Report on revival of rural cooperative credit institutions, Reorganisation of Cooperative credit structure in Andhra Pradesh and single window system and successful cooperative credit systems in Gujarat, Maharashtra, Punjab etc, - Special cooperatives: LAMPS and FSS: Objectives, role and functions - National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd., (NAFSCOB) - Objectives and Functions.

UNIT - V	BANKING AND INSURANCE	9

Negotiable Instruments: Meaning, Importance and Types - Central Bank: RBI - functions - credit control - objectives and methods: CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money - Financial inclusion and Exclusion: Credit widening and credit deepening monetary policies. Credit gap: Factors influencing credit gap - Non - Banking Financial Institutions (NBFI) - Preparation of Bankable Projects - Assessment of crop losses, Determination of compensation - Crop insurance: Schemes, Coverage, Advantages and Limitations in implementation - Estimation of crop yields - Livestock, insurance schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the knowledge on sources of Agricultural Micro-Macro financing and credit systems.
CO2	Outline the history of financing agriculture in India.
CO3	Relate the significance and limitations of crop insurance.
CO4	Infer the knowledge on cooperative systems.
CO5	Summarize the knowledge on insurance policies and financial system.

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Text Books	
1.	Muniraj, R. 1987. Farm Finance for Development. Oxford & IBH. New Delhi.
2.	Subba Reddy, S and P. Raghu Ram. 2011. Agricultural Finance and Management. Oxford & IBH. New Delhi.
3.	Lee, W.F., M.D. Boehlje, A.G. Nelson and W.G. Murray. 1998. Agricultural Finance.
4.	Kalyani Publishers. New Delhi.
5.	Mammoria, C.B. and R.D. Saxena. 1973. Cooperation in India. Kitab Mahal. Allahabad.
6.	Patnaik, V.E. and A.K. Roy. 1988. Cooperation and Cooperative Management. Kalyani Publishers. Ludhiana.

Reference Books	
1.	Ghosal, SN., Agricultural Financing in India, Asia Publishing House, Bombay, 1966.
2.	John, J.Hamptron., Financial Decision Making: Concepts, Problems and Cases, Prentice-Hall of India , New Delhi, 1983
3.	https://www.nabard.org/

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B.E.	B19BMO801- HOSPITAL MANAGEMENT (Common to all Except BME)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of hospital administration.
2.	Learn human resource management in hospital.
3.	Know the market-related research process.
4.	Explore various information management systems and relative supportive services.
5.	Learn the quality and safety aspects of the hospital.

UNIT - I	OVERVIEW OF HOSPITAL ADMINISTRATION	9

Distinction between Hospital and Industry, Challenges in Hospital Administration - Hospital Planning - Equipment Planning - Functional Planning - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management.

UNIT - II	HUMAN RESOURCE MANAGEMENT IN HOSPITAL	9

Principles of HRM - Functions of HRM - Profile of HRD Manager - Tools of HRD - Human Resource Inventory - Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines - Methods of Training - Evaluation of Training - Leadership grooming and Training, Promotion - Transfer, Communication - nature, scope, barriers, styles and modes of communication.

UNIT - III	MARKETING RESEARCH PROCESS	9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations - Consumer Markets & Consumer Buyer Behavior - Model of consumer behavior - The buyer decision process - Model of business buyer behavior - Major types of buying situations - WTO and its implications.

UNIT - IV	HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES	9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administration Information Systems - Support Service Technical Information Systems - Medical Transcription, Medical Records Department - Central Sterilization and Supply Department - Pharmacy - Food Service - Laundry Services.

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UNIT - V	QUALITY AND SAFETY ASPECTS IN HOSPITAL	9
Quality system - Elements, Implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 - 9004 - Features of ISO 9001 - ISO 14000 - Environment Management Systems. NABA, JCI, NABL. Security - Loss Prevention - Fire Safety - Alarm System - Safety Rules. Health Insurance & Managing Health Care - Medical Audit - Hazard and Safety in a hospital Setup.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the principles of Hospital adminstration.
CO2	Identify the importance of Human resource management.
CO3	List various marketing research techniques.
CO4	Identify Information management systems and its uses.
CO5	Summarize the quality and safety procedures followed in hospitals

Text Books	
1.	R.C. Goyal, Hospital Administration and Human Resource Management, PHI - Fourth Edition, 2006.
2.	G.D. Kunders, Hospitals - Facilities Planning and Management - TMH, New Delhi, Fifth Reprint 2007.

Reference Books	
1.	Cesar A. Caceres and Albert Zara, The Practice of Clinical Engineering Academic Press, New York, 1977.
2.	Norman Metzger, Handbook of Health Care Human Resources Management, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3.	Peter Berman, Health Sector Reform in Developing Countries, Harvard University Press, 1995.
4.	William, A. Reinke, Health Planning For Effective Management, Oxford University Press, 1988.
5.	Blane, David, Brunner, Health and Social Organization: Towards a Health Policy for the 21st Century, Eric Calrendon Press 2002.
6.	Arnold D. Kalcizony & Stephen M. Shortell, Health Care Management, 6th Edition Cengage Learning, 2011.

BoS Chairman

B.TECH.	B19BTO801 - BIOLOGICAL WASTE MANAGEMENT (Common to all Except BT)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To develop conceptual schematics for biological treatment of wastes.
2.	To understand the role of microbes in waste treatment
3.	To equip students to understand the basics of biodegradation and bioremediation.
4.	To provide the overview integrated biotechnology approaches for effective waste management.

UNIT - I	INTRODUCTION	9

Industrial waste generation, disposal and environmental impacts; Toxicity of industrial effluents and Bioassay tests; Brief introduction about Regulatory requirements and pollution control boards. Biological treatment processes - objectives; Choice of treatment method; Environmental impact and other considerations in planning the treatment.

UNIT - II	MICROBIAL TREATMENT OF WASTE WATER	9

Biological waste water treatment - Aerobic suspended growth; Aerobic attached - growth (TF, RBC, PBR); Anaerobic suspended growth; Anaerobic attached growth; Advanced tertiary process:-Solids removal; Biological nitrogen removal; Biological phosphorus removal; Disinfection.

UNIT - III	BIODEGRADATION	9

Aerobic vs. anaerobic Degradation; Mechanism of biodegradation; Microbial basis of Biodegradation; Biodegradation of Xenobiotics; Microbial degradation of pesticides. Role of nanoparticles in biodegradation.

UNIT - IV	BIOREMEDIATION	9

Introduction of Bioremediation; advantages and applications; Types of bioremediation; Natural (attenuation); ex situ and in situ; Bioaugmentation and biostimulation; Solid phase and slurry phase bioremediation; Phytoremediation. Case study on bioremediation of xenobiotic compounds.

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UNIT - V	INTEGRATED BIOTECHNOLOGY FOR WASTE MANAGEMENT	9
Bioenergy - biogas and biodiesel; Biosorption, mechanism of biosorption; Biosensors and its application in environmental issues; Biomonitoring; Biotransformation, mineral leaching, mining and mineral biotechnology - reference to copper and iron.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the industrial waste generation and its environmental impact
CO2	Understand the role microbes in waste water treatment.
CO3	Explain the mechanism of biodegradation of organic wastes.
CO4	Understand the bioremediation of toxic compounds.
CO5	Understand the integrated biotechnology methods for waste management.

Text Books	
1.	Eckenfelder WW, "Industrial Water Pollution Control", Mc-Graw Hill, 1999.
2.	Metcalf and Eddy, “Waste Water Engineering - Treatment and reuse”, Tata McGraw-Hill, New Delhi, 2003.
3.	Agarwal S.K., “Environmental Microbiology”, APH Publishing Corporation, New Delhi, 2009.
4.	Chatterji A.K., “Introduction to Environmental Biotechnology”, PHI Learning Pvt. Ltd., New Delhi, 2011.
5.	Maier RM, IL Pepper and CP Gerba, “Environmental Microbiology”, Academic Press. 2000.
6.	Pelczar MJ, ECS Chan and NR Kreig, “Microbiology”, 5th Ed., Tata McGraw Hill, New Delhi, 2002.

BoS Chairman

B.E.	B19CSO801 - FUNDAMENTAL OF IoT (Common to all except CSE, AI & DS, CSBS)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand and gain complete knowledge about internet of things.
2.	To study about network protocols.
3.	To learn basic programming and IoT tools.
4.	To understand the basics of embedded systems in IoT.
5.	To explore various IoT applications

UNIT - I	INTRODUCTION	9
Basics of IoT, Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, Functional Blocks of IoT, Communication Models & APIs, Machine to Machine, Difference between IoT and M2M.		
UNIT - II	**NETWORK AND COMMUNICATION ASPECTS**	**9**
Wireless Medium Access Issues, MAC Protocol Survey, Survey Routing protocols, Sensor Deployment & Node Discovery, Data Aggregation & Dissemination.		
UNIT - III	**ISSUES AND CHALLENGES IN IOT**	**9**
Design Challenges, Development Challenges, Security Challenges, Issues related to Privacy, Standards and Regulation.		
UNIT - IV	**DEVELOPING INTERNET OF THINGS**	**9**
Introduction to different IoT Tools, Developing Applications through IoT Tools, Developing Sensor based Application through Embedded System Platform, Implementing IoT concepts with examples.		
UNIT - V	**DOMAIN SPECIFIC APPLICATIONS**	**9**
IoT applications - Home Automation-Agriculture- Health care - Surveillance Applications - Smart Grid - Introduction to Industrial IoT (IIoT).		
		Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Explain the concepts of Internet of Things.
CO2	Analyze basic protocols in Wireless Sensor Network.
CO3	Outline the issues of IoT application design in different domains.
CO4	Illustrate the use of IoT tools and its performance.
CO5	Identify the IoT concepts and applications.

Text Books	
1.	Perry Lea, “Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security”, Packt, 2018.
2.	David Hanes, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco press, 2017.

Reference Books	
1.	Samuel Greengard, “The Internet of Things”, MIT Press, 2015.
2.	Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Wiley, 2012.
3.	Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks: Theory and Practice”, 2010.

BoS Chairman

B.E./ B.TECH	B19ECO801 - WIRELESS TECHNOLOGIES (Common to all Except ECE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To provide basic understanding about wired and wireless communication.
2.	To have an exposure to Internet of Things and applications.
3.	To know the basic wireless network security.
4.	To get exposed to antenna systems.
5.	To understand various satellite communication.

UNIT - I	FUNDAMENTALS OF COMMUNICATION	9
Basics of Communication, Spectrum - FCC, Transceiver design and its Components, Wired and wireless communication. Modulation techniques, OSI Layers, TCP/IP Protocols 1G to 5G developments; 3G, 4G and 5G cell architecture.		

UNIT - II	INTERNET OF THINGS	9
Introduction, IoT- Architecture, IEEE 802.15.4, M2M and IoT Protocols, SCADA and RFID Protocols, Architecture and Applications - Bluetooth, Zigbee, LORA, 6LOWPAN, Wi-Fi, WIMAX.		

UNIT - III	WIRELESS NETWORK SECURITY	9
Cryptography, Integrity, Authentication and Key management, Wireless Threats - Hacking 802.11, Eavesdropping, Jamming, Cyber-crimes and awareness - countermeasures, Wireless Security.		

UNIT - IV	ANTENNA SYSTEMS	9
Introduction, Types of Antennas, Radiation Mechanisms and Measurements, Dipole, Monopole, Mobile Phone Antenna, Smart Antennas, RFID antennas, Automotive Antenna, Reconfigurable Antennas, SAR measurements.		

UNIT - V	SATELLITE COMMUNICATION	9
Basic principles, Kepler's law, Types of satellites - LEO, MEO and GEO. Launch Vehicles, Satellite Subsystems and Satellite links, Applications - GPS, Mobile communication and TV broadcast, Navigation systems, Modern Navigation systems.		
		Total Instructional hours : 45

R. Gowri

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Course Outcomes : Students will be able to	
CO1	Analyze the wired and wireless communication and networks.
CO2	Develop Internet of Things for various applications
CO3	Apply security protocols in Wireless Networks
CO4	Discover various antenna systems for Wireless Technologies
CO5	Explain the Satellite Communication technologies

Text Books	
1.	John G Proakis, MasoudSalehi, "Communication Systems Engineering" Prentice Hall, 1994.
2.	Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things- Key applications and Protocols", Wiley 2012.

Reference Books	
1.	Dennis Roddy, "Satellite Communication", 4th Edition, Tata McGraw-Hill, 2009.
2.	Behrou A. Forouan, "Data Communication and Networking", 5th Edition, Tata McGraw Hill, 2013.
3.	Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", VPT, 1st Edition, 2014.
4.	AfifOsseiran, Jose.F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.
5.	KasunMaduranga Silva Thotahewa(Author), Jean-Michel Redoute(Author), Mehmet RasitYuce, "Ultra Wideband Wireless Body Area Networks", Springer, 2016.
6.	Timothy Pratt and Charles W.Bostain, "Satellite Communications", John Wiley and Sons, 2nd Edition, 2012.
7.	M. Richharia, "Satellite Systems for Personal Applications", John Wiley, 2010.
8.	Balanis. A, "Antenna Theory Analysis and Design", 3rd Edition, John Wiley and sons, New York, 1982.
9.	William Stallings, "Cryptography & Network Security - Principles and Practices", Pearson Education, 4th Edition, 2006.

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B.E. / B.TECH	B19MEO801 - LEAN SIX SIGMA (Common to all Except MECH)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To describe about introduction to Six Sigma.
2.	To discuss the importance of Set up time, TQM, 5S, VSM.
3.	To describe about introduction to lean manufacturing.
4.	To study the various tools for lean manufacturing.
5.	To describe about lean involvement and culture.

UNIT - I	INTRODUCTION TO SIX SIGMA	9

Six Sigma - Definition, statistical considerations, variability reduction, design of experiments - Six Sigma implementation.

UNIT - II	SET UP TIME REDUCTION, TQM, 5S, VSM	8

Set up time reduction - Definition, philosophies and reduction approaches. TQM - Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT - III	INTRODUCTION TO LEAN MANUFACTURING	9

Conventional Manufacturing versus Lean Manufacturing - Principles of Lean Manufacturing - Basic elements of lean manufacturing - Introduction to LM Tools.

UNIT - IV	LEAN TOOLS AND METHODOLOGY	9

Primary tools - , Workplace organization - Stability - Just-In-Time - Takt time- One piece flow - Pull, Cellular systems, , Six Sigma. SMED: Single minute exchange of dies -theory and practice of the SMED system - TPM, Pillars of TPM, Conditions for TPM success,TPM implementation process - Overall Equipment Effectiveness - computation of OEE.

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UNIT - V	LEAN INVOLVEMENT AND CULTURE	11
Necessity of involvement - Waste of Humanity - Activities supporting involvement - Kaizen Circle Activity - Practical Kaizen Training - Key factors in Practical Kaizen Training - Lea Culture - Standardization - Standards and abnormality control - 'Five Why' analysis.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the fundamental principle of six sigma.
CO2	Apply techniques, skills and modern engineering tools necessary for production design.
CO3	Understand the principles of Lean Manufacturing.
CO4	Identify the various lean tools and methodologies.
CO5	Understand the implementation of lean and work culture in shop floor.

Text Books	
1.	Dennis P, "Lean Production Simplified: A Plain Language Guide to the World's Most powerful Production System", Productivity Press, New York, 2009.
2.	Liker J. and Meier D., "The Toyota Way", Field book, McGraw-Hill, 2010.
3.	N. Gopalakrishnan, "Simplified Lean Manufacture", PHI, 2010.

Reference Books	
1.	Devadasan S. R., Mohan Sivakumar V., Murugesh R. and Shalij P. R., "Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities", Prentice Hall of India Learning Limited, New Delhi, 2012.
2.	Gopalakrishnan N., "Simplified Lean Manufacture: Elements, Rules, Tools and implementation", Prentice Hall of India Learning Private Limited, India, 2010.
3.	Bill Carr ira, "Lean Manufacturing that Works: Powerful Tools for Dramatically Reducing Wastes and Maximizing Profits", Prentice Hall of India Learning Private Limited, India, 2009.
4.	Don Tapping, Tom Lu ster and Tom Shuker, "Value Stream Management: Eight Steps to Planning, Mapping and Sustaining Lean Improvements", Productivity Press, New York, USA, 2007.

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B.E.	B19EEP801 - PROJECT WORK PHASE - II	T	P	TU	C
		0	16	0	8

Course Objectives	
1.	To develop their own innovative ideas into prototype.
2.	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
3.	To Design and developprojects based on hardware and software for electrical systems.
4.	To improve the team building, communication and management skills among the students.
5.	To train the students in preparing project reports and viva voce examination.

Project work may be assigned to a single student or to a group of students not exceeding 4 per group, under the supervision of faculty guide(s). The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three faculty members in the review committee. There shall be three reviews in total, during the semester by a review committee. The student shall make presentation on the progress made before the committee.

Interim project report shall be submitted before the project reviews with the approval of the guide. The Project Report, prepared according to the approved guidelines and duly signed by the guide and the Head of the Department, shall be submitted to the department as per the timeline announced by the department. The End Semester Examination for project work shall consist of evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted separately for each student, by a committee consisting of the external examiner, and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work.

Total Instructional hours : 240

Course Outcomes : Students will be able to	
CO1	Identify the problems of society with current relevance.
CO2	Apply theoretical concepts to societal/Industrial complex problems with team work and Multidisciplinary approach.
CO3	Develop the confidence for the self education, effective communication and ability for life long learning.
CO4	Design engineering solution by utilizing a systems approach with appropriate software / hardware tools for the identified problems.
CO5	Test for the software / hardware modules of the developed project.

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