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)
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 DEGREE
IN
AGRICULTURE ENGINEERING

DEPARTMENT OF AGRICULTURE ENGINEERING

Vision and Mission of the Department

Vision

◎	To achieve the highest caliber in Agriculture Engineering Teaching, Research and Training and to develop intellectual leaders for the betterment of the society, environmental protection and modern technological needs for the agriculture sector.

Mission

◎	To provide high quality education to students through advanced skill based learning and molding them a technologically sound and ethinically motivated youth through value added programmes.
◎	To establish the state of art laboratories in farm machineriery, soil water conservation, processing, value addition and renewable energy with the development of affordable technologies in the above areas with linkages of various industries for promotion of agriculture in view of labour, water scarcity and price insatability.
◎	To impart various training programmes and demonstrations on various latest techniques to the farmers, officials and entrepreneurs for maximizing returns from agriculture.

Program Educational Objectives (PEO's)

PEO 1	Graduates will have a successful professional career in the field of Agriculture Engineering and related disciplines.
PEO 2	Graduates will formulate, analyse and provide solution to the real world problems faced by the farmers through applying the knowledge in the field of Agriculture Engineering.
PEO 3	Graduates will have commitment to life long learning with mechanization knowledge and apply their career for flourishing the farming community.

Programme Outcomes (PO's)

Engineering Graduates will be able to

PO 1	**Engineering Knowledge :** Apply the knowledge of mathematics, science, engineering in agriculture.
PO 2	**Problem Analysis :** Ability to design and conduct experiments, analyze and interpret data to prepare farm specific report.
PO 3	**Design / Development of Solutions :** Ability to design an irrigation system to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, and sustainability.

PO 4	**Conduct Investigations of Complex Problems :** Ability to think creatively, to formulate problem statements, to communicate effectively, to synthesize information, and to evaluate agricultural systems.
PO 5	**Modern Tool Usage :** Ability to function in interdisciplinary teams within the institute and also with other organizations at National/International level while planning the research projects.
PO 6	**The Engineer and Society :** Ability to use techniques, skills and modern engineering tools necessary for Agricultural engineering practice.
PO 7	**Environment and Sustainability :** Will develop competencies in computer and automatic control system, information system, mechanical systems, natural resource systems to solve engineering problems.
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 :** Graduates will be able to express themselves clearly in oral and verbal communication needs.
PO 11	**Project Management and Finance :** Ability to devise a strategy or action plan to utilize the acquired knowledge in increasing water-use efficiency, farm mechanization and post harvest technology etc.
PO 12	**Lifelong Learning :** Graduates will be capable of self-education in emerging problems and understand the value of lifelong learning in food technology, Farm machinery and Food processing.

Program Specific Outcome (PSO's)	
PSO 1	Apply the agricultural engineering design and concepts, methodologies and techniques for effective and efficient agricultural production.
PSO 2	Analyze the real time agriculture problems and to provide solutions by applying appropriate technology.
PSO 3	Develop employment and entrepreneurial ability in different disciplines of agricultural engineering.

BoS Chairman

UG Regulations

1. SHORT TITLE AND COMMENCEMENT

- These Regulations shall be called the "KIT-Kalaignarkaraunanidhi 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**	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 **Annexure 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 **Annexure V**)

4. ADMISSION

4.1 B.E. / B.Tech. Degree Programme (I 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 exception 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)**
Project Work(PW)		
Career Enhancement Courses(CEC)		
Mandatory Course (MC)		

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 Assigned

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 training activities 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 assessment 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 Annexure - I.

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 7th and 8th semester or 8th 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 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-I, CIA-II, CIA-III 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-I, CIA-II, CIA-III and ESE.

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

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

S. No.	Category of course	Continuous Internal Assessment	Semester End Examinations
1.	Theory Courses	40 Marks	60 Marks
2.	Laboratory Courses		
3.	Project Work		
4.	Career Enhancement Course (CEC) and Mandatory Course (MC)	100 Marks	-

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 - I CIA - II and CIA - III)

2 Marks	12 Marks	Total marks
7	3 (Either or Type)	50

b. Table 7.2 End Semester Examinations

2 Marks	13 Marks	15 marks	Total Marks
10	5 (Either or Type)	1 (Either or Type)	100
For Mathematics paper only			
2 Marks	16 Marks		Total Marks
10	5 (Either or Type)		100
For Engineering Graphics only			
20 Marks			Total Marks
5			100

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 I	1.5 Units	1.5 hours	50 marks	10
Continuous Internal Assessment II	1.5 Units	1.5 hours	50 marks	10
Continuous Internal Assessment III	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.	Semester End 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 favor 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.

16.3 Formula for SGPA and CGPA calculations

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.

$$\textbf{S}\text{emester }\textbf{G}\text{rade }\textbf{P}\text{oint }\textbf{A}\text{verage} = \frac{\sum(C_i \times GP_i)}{\sum C_i}$$

where $\mathbf{C_i}$ is the credit for a course in that semester and $\mathbf{GP_i}$ 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 **P**oint **A**verage **(CGPA)** up to that point of time

$$\textbf{C}\text{umulative }\textbf{G}\text{rade }\textbf{P}\text{oint }\textbf{A}\text{verage} = \frac{\sum(C_i \times GP_i)}{\sum C_i}$$

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

16.4 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 planning 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

B	1	9	M	E	T	7	0	9
Programme	Regulation		Department Code		Course Type	Semester	Sequence Number	

Programme :

Bachelor Degree (B.E./B.Tech) - B

Master's Degree (M.E./M.Tech/MBA/MCA) - M

Regulation :

R - 19

Department Code :

AE - Aeronautical Engineering

AG - Agricultural Engineering

BT - Bio Technology

BM - Bio Medical Engineering

CS - Computer Science and Engineering

EC - Electronics and communication Engineering

EE - Electrical and Electronics Engineering

ME - Mechanical Engineering

CA - Computer Application

MB - Management Studies

CH - Chemistry

EN - English

PH - Physics

MA - Mathematics

MC - Mandatory Course

CE - Career Enhancement

Course Type

T - Theory

P - Practical / Project/ Internship

E - Elective

O - Open Elective

C - One Credit Courses

N - Online courses

S-Special Electives

Semester

1 - First Semester

2 - Second Semester

3 - Third Semester

4 - Fourth Semester

5 - Fifth Semester

6 - Sixth Semester

7 - Seventh Semester

8 - Eighth Semester

Sequence Number

00-99

ANNEXURE - II

POLICY ON MALPRACTICES

GENERAL

- It shall be the endeavor 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 honor 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

Sl.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 neighboring 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
10.	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.	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.
11.	The candidate possessing cell phone(s)/ programmable calculator(s)/any other electronic storage device(s) gadgets and containing incriminating materials (whether used or not).	
12.	The Candidate possessing the question paper of another candidate with additional writing on it.	
13.	The candidate passing his/her question paper to another candidate with additional writing on it	
14.	The candidate passing incriminating materials brought into the examination hall in any medium (hard/soft) to other candidate(s).	
15.	The candidate copying from neighboring candidate.	
16.	The candidate taking out of the examination hall answer booklet(s), used or unused	
17.	Appeal by the candidate in the answer script coupled with a promise of any form of consideration.	
18.	Candidate destroying evidence relating to an alleged irregularity.	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. **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	

24.	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.	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.
25.	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.	
26.	Candidate possessing any fire arm / weapon inside the examination hall.	
27.	Cases of Impersonation	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.

ANNEXURE - 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.

ANNEXURE - 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**
B19CHT101	Engineering Chemistry	**BS**	3	3	0	0	**3**	40	60	100	**3**
B19CST102	Problem Solving and Programming Using C	**ES**	3	3	0	0	**3**	40	60	100	**3**
B19MET101	Engineering Graphics	**ES**	6	2	4	0	**3**	40	60	100	**4**
B19CHP101	Chemistry Laboratory	**BS**	4	0	4	0	**3**	40	60	100	**2**
B19CSP102	Problem Solving and Programming Using C 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**
B19PHT101	Engineering Physics	**BS**	3	3	0	0	**3**	40	60	100	**3**
B19MET201	Engineering Mechanics	**ES**	3	2	0	1	**3**	40	60	100	**3**
B19AGT201	Principles and Practices of Crop Production	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19HST201	தமிழ்மரபு / Heritage of Tamils	**HS**	1	1	0	0	**3**	40	60	100	**1**
B19PHP101	Physics Laboratory	**BS**	4	0	4	0	**3**	40	60	100	**2**
B19AGP201	Crop Husbandry Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
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			**30**	**14**	**14**	**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
B19AGT301	Soil Physics and Mechanics	PC	3	3	0	0	3	40	60	100	3
B19AGT302	Theory of Machines	PC	3	3	0	0	3	40	60	100	3
B19AGT303	Surveying and Levelling	ES	3	3	0	0	3	40	60	100	3
B19EET305	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3	40	60	100	3
B19MCT302	Indian Constitution	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
B19AGP301	Surveying and LevellingLaboratory	ES	4	0	4	0	3	40	60	100	2
B19AGP302	Soil Physics Laboratory	PC	4	0	4	0	3	40	60	100	2
B19CEP301	Soft Skill - 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	12	1	Total Credits				23
In-plant training minimum one week (Review will be conducted in the first week of Semester IV and it will be included in 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	
B19MAT403	Probability and Statistics	BS	4	3	0	1	3	40	60	100	4
B19AGT401	Unit Operations inAgricultural Processing	PC	3	3	0	0	3	40	60	100	3
B19AGT402	Fluid Mechanics and Hydraulics	PC	3	2	0	1	3	40	60	100	3
B19AGT403	Thermodynamics and Heat Transfer	ES	4	3	0	1	3	40	60	100	4
B19AGT404	Strength of Materials	ES	3	2	0	1	3	40	60	100	3
B19MCT301	Environmental Science	MC	3	3	0	0	-	100	-	100	NC
B19AGP401	Fluid MechanicsLaboratory	PC	4	0	4	0	3	40	60	100	2
B19AGP402	Strength of MaterialsLaboratory	ES	4	0	4	0	3	40	60	100	2
B19CEP401	Career Ability Course - I	CEC	2	0	2	0	-	100	-	100	NC
B19CEP402	In-plant training	CEC	-	-	-	-	-	-	-	-	NC
B19CEP403	Online Certificate Course	CEC	-	-	-	-	-	-	-	-	NC
Total Contact Hours/Week			30	16	10	4	Total Credits				21
Summer Internship - Duration 15 days(Review will be conducted in first week of Semester V and its credit will be included in Semester V) Online Certificate Courses (like NPTEL/other Online Courses) 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	
B19AGT501	Farm Tractors	PC	3	3	0	0	3	40	60	100	3
B19AGT502	Farm Machinery andEquipment	PC	3	3	0	0	3	40	60	100	3
B19AGT503	Post Harvest Technology	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
B19AGP501	Post Harvest Engineering Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGP502	Operation & Maintenance of Farm Machinery Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGP503	Mini Project	PW	4	0	4	0	-	100	-	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	-	-	-	-	-	100	-	100	1
B19CEP504	Rural Agricultural Engineering Work Experience	CEC	-	-	-	-	-	100	-	100	1
Total Contact Hours/Week			31	15	16	0	Total Credits				24

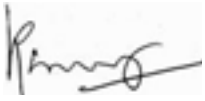
Semester - VI											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AGT601	Engineering Materials, Construction, Estimation and Costing	PC	3	3	0	0	3	40	60	100	3
B19AGT602	Irrigation and Drainage Engineering	PC	3	3	0	0	3	40	60	100	3
B19AGT603	Design of Basic MachineElements	PC	3	2	0	1	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
B19AGP601	Irrigation Field Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGP602	ICT Laboratory for Agricultural Engineers	PC	4	0	4	0	3	40	60	100	2
B19AGP603	Food Process EngineeringLaboratory	PC	4	0	4	0	3	40	60	100	2
B19CEP601	Career Ability Course-III	CEC	2	0	2	0	-	100	-	100	NC
B19CEP602	Online Certificate Course	CEC	-	-	-	-	-	-	-	-	NC
Total Contact Hours/Week			32	17	14	1	Total Credits				24
Online Certificate Courses (like NPTEL) has to be completed within third year (NC) – 15 days											

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	
B19AGT701	Soil and WaterConservation Engineering	PC	3	3	0	0	3	40	60	100	3
B19AGT702	Solar, Wind and Bio-EnergyEngineering	PC	3	2	0	1	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
B19AGP701	Design and Drawing of FarmStructures	PC	5	0	4	1	3	40	60	100	3
B19AGP702	GIS Laboratory forAgricultural Engineers	PC	4	0	4	0	3	40	60	100	2
B19AGP703	Renewable EnergyLaboratory	PC	4	0	4	0	3	40	60	100	2
Total Contact Hours/Week			28	14	12	2	Total Credits				22

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
B19AGP801	Project Work	PW	20	0	20	0	3	40	60	100	10
Total Contact Hours/Week			26	6	20	0	Total Credits				16

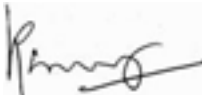
HUMANITIES AND SOCIALSCIENCES (HS)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19ENT101	Functional English	HS	3	3	0	0	3	40	60	100	3
B19ENT201	ProfessionalEnglish	HS	3	3	0	0	3	40	60	100	3
B19HST201	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



BoS Chairman

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	Matrices and Differential Calculus	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
B19MAT201	Integral Calculus and Complex Analysis	BS	4	3	0	1	4	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
B19MAT303	Transforms and Partial Differential Equations	BS	4	3	0	1	3	40	60	100	4
B19MAT403	Probability and Statistics	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	
B19CST102	Problem Solving and Programming Using C	ES	3	3	0	0	3	40	60	100	3
B19MET101	Engineering Graphics	ES	6	2	4	0	3	40	60	100	4
B19CSP102	Problem Solving and Programming Using C Laboratory	ES	4	0	4	0	3	40	60	100	2
B19MET201	Engineering Mechanics	ES	3	2	0	1	3	40	60	100	3
B19MEP201	Workshop Practices Laboratory	ES	4	0	4	0	3	40	60	100	2
B19AGT303	Surveying and Levelling	ES	3	3	0	0	3	40	60	100	3
B19EET305	Basics of Electrical andElectronics Engineering	ES	3	3	0	0	3	40	60	100	3
B19AGP301	Surveying and Levelling Laboratory	ES	4	0	4	0	3	40	60	100	2
B19AGT403	Strength of Materials	ES	3	2	0	1	3	40	60	100	3
B19AGP401	Strength of Materials Laboratory	ES	4	0	4	0	3	40	60	100	2
B19AGT403	Thermodynamics and Heat Transfer	ES	3	3	0	1	3	40	60	100	4



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	
B19AGT201	Principles and Practices of Crop Production	PC	3	3	0	0	3	40	60	100	3
B19AGP201	Crop Husbandry Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGT301	Soil Physics and Mechanics	PC	3	3	0	0	3	40	60	100	3
B19AGT302	Theory of Machines	PC	3	3	0	0	3	40	60	100	3
B19AGP302	Soil Physics Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGT401	Unit Operations in Agricultural Processing	PC	3	3	0	0	3	40	60	100	3
B19AGT402	Fluid Mechanics and Hydraulics	PC	3	2	0	1	3	40	60	100	3
B19AGP401	Fluid Mechanics Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGT501	Farm Tractors	PC	3	3	0	0	3	40	60	100	3
B19AGT502	Farm Machinery and Equipment	PC	3	3	0	0	3	40	60	100	3
B19AGT504	Post Harvest Technology	PC	3	3	0	0	3	40	60	100	3
B19AGP501	Post Harvest Engineering Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGP502	Operation and Maintenance of Farm Machinery Lab	PC	4	0	4	0	3	40	60	100	2
B19AGT601	Engineering Materials, Construction, Estimation and Costing	PC	3	3	0	0	3	40	60	100	3
B19AGT602	Irrigation and Drainage Engineering	PC	3	3	0	0	3	40	60	100	3
B19AGT603	Design of Basic Machine Elements	PC	3	2	0	1	3	40	60	100	3
B19AGP601	Irrigation Field Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGP602	ICT Laboratory for Agricultural Engineers	PC	4	0	4	0	3	40	60	100	2
B19AGP603	Food Process Engineering Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AGT701	Soil and Water Conservation Engineering	PC	3	3	0	0	3	40	60	100	3
B19AGT702	Design and Drawing of Farm Structures	PC	4	0	4	0	3	40	60	100	3
B19AGT703	Solar, Wind and Bio Energy Engineering	PC	3	2	0	1	3	40	60	100	3
B19AGP701	GIS Laboratory for Agricultural Engineers	PC	4	0	4	0	3	40	60	100	2
B19AGP702	Renewable Energy Laboratory	PC	4	0	4	0	3	40	60	100	2

BoS Chairman

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	
B19AGE501	Hydrology and Water Resources Engineering	PE	3	3	0	0	3	40	60	100	3
B19AGE502	Systems Analysis and Soft Computing in Agricultural Engineering	PE	3	3	0	0	3	40	60	100	3
B19AGE503	IT in Agricultural Systems	PE	3	3	0	0	3	40	60	100	3
B19AGE504	Agricultural Waste Management	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	
B19AGE601	Food and Dairy Engineering	PE	3	3	0	0	3	40	60	100	3
B19AGE602	Agricultural Business Management	PE	3	3	0	0	3	40	60	100	3
B19AGE603	Agricultural Economics and Farm Management	PE	3	3	0	0	3	40	60	100	3
B19AGE604	Ergonomics and safety in Agricultural Engineering	PE	3	3	0	0	3	40	60	100	3

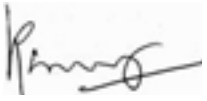
Semester - VI											
Elective – III											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AGE605	Sustainable Agriculture and Food Security	PE	3	3	0	0	3	40	60	100	3
B19AGE606	Agricultural Extension	PE	3	3	0	0	3	40	60	100	3
B19AGE607	Disaster management	PE	3	3	0	0	3	40	60	100	3
B19AGE608	Heat and Mass Transfer for Agriculture Engineering	PE	3	3	0	0	3	40	60	100	3

BoS Chairman

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	
B19AGE701	Process Engineering of Fruits and Vegetables	PE	3	3	0	0	3	40	60	100	3
B19AGE702	Climate Change and Adaptation	PE	3	3	0	0	3	40	60	100	3
B19AGE703	Intellectual Property Rights and Ethics	PE	3	3	0	0	3	40	60	100	3
B19AGE704	Remote Sensing and Geographical Information System	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	
B19AGE705	Storage and Packaging Technology	PE	3	3	0	0	3	40	60	100	3
B19AGE706	Protected Cultivation	PE	3	3	0	0	3	40	60	100	3
B19AGE707	Refrigeration and Air Conditioning	PE	3	3	0	0	3	40	60	100	3
B19AGE708	On Farm Water Management	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	
B19AGE801	Micro Irrigation	PE	3	3	0	0	3	40	60	100	3
B19AGE802	Watershed Management	PE	3	3	0	0	3	40	60	100	3
B19AGE803	Tillage Mechanics and Traction	PE	3	3	0	0	3	40	60	100	3
B19AGE804	Special Farm Equipments	PE	3	3	0	0	3	40	60	100	3



BoS Chairman

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
B19BMO501	Introduction to Medical Physics	**OE**	3	0	3	0	3	40	60	100	3
B19BTO501	Food Processing and Preservation	**OE**	3	0	3	0	3	40	60	100	3
B19CSO501	Fundamentals of Database Management System	**OE**	3	3	0	0	3	40	60	100	3
B19ECO501	Logic and Distributed Control System	**OE**	3	3	0	0	3	40	60	100	3
B19EEO501	Rotating Machines and Transformers	**OE**	3	3	0	0	3	40	60	100	3
B19MEO501	Robotics	**OE**	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**	
B19AEO601	Aircraft Electrical and Electronic Systems	**OE**	3	3	0	0	3	40	60	100	3
B19BMO601	Introduction to Biomedical Engineering	**OE**	3	3	0	0	3	40	60	100	3
B19BTO601	Basic Bioinformatics	**OE**	3	0	3	0	3	40	60	100	3
B19CSO601	E- Commerce Technology Management	**OE**	3	3	0	0	3	40	60	100	3
B19ECO601	Geographic Information System	**OE**	3	3	0	0	3	40	60	100	3
B19EEO601	Fundamentals of Power Electronics	**OE**	3	3	0	0	3	40	60	100	3
B19MEO601	Entrepreneurship Development	**OE**	3	0	3	0	3	40	60	100	3

BoS Chairman

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 & MRO	OE	3	3	0	0	3	40	60	100	3
B19BMO701	Telemedicine	OE	3	3	0	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
B19EEO701	Hybrid Electrical Vehicles	OE	3	3	0	0	3	40	60	100	3
B19MEO701	3D Printing and Tooling	OE	3	0	3	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
B19BMO801	Hospital Management	OE	3	3	0	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	0	3	0	3	40	60	100	3
B19EEO801	Energy Conservation and Management	OE	3	3	0	0	3	40	60	100	3
B19MEO801	Lean Six Sigma	OE	3	0	3	0	3	40	60	100	3

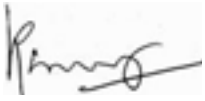
PROJECT WORK (PW)												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AGP503	Mini Project	PW	4	0	4	0	-	100	-	100	2
B19AGP801	Project Work	PW	20	0	20	0	3	40	60	100	10

BoS Chairman

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 / Study Tour	CEC	-	-	-	-	-	-	-	-	NC
B19CEP403	Online Certificate Courses - 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
B19CEP504	Rural Agricultural Engineering Work Experience	CEC	-	-	-	-	-	100	-	100	1

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

OPEN ELECTIVE COURSES-OFFERED BY DEPARTMENT OF AGRICULTURE ENGINEERING											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AGO501	Environment and Agriculture	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
B19AGO701	Production Technology for Agricultural Machinery	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



BoS Chairman

Semester - I

B.E / B.Tech	B19ENT101 - FUNCTIONAL ENGLISH (Common to all Branches)	T	P	TU	C
		2	0	1	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.

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.	

BoS Chairman

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 one self, 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

BoS Chairman

Listening	Listening to talks, conversations
Speaking	Participating in conversations, short group conversations
Language development	Spelling and Punctuations, modal verbs
Vocabulary development	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. 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: New Delhi, 2014
2.	Kumar, Suresh. E. “Engineering English” Orient Blackswan: Hyderabad, 2015.
3.	Booth L. Diana, Project Work, Oxford University Press, Oxford: 2014.

BoS Chairman

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.	The syllabus is designed to provide the basic tools of differential calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.

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).		

BoS Chairman

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	Determine solution for maxima and minima problems
CO3	To 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.

BoS Chairman

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.

BoS Chairman

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.

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 and interpret about the basics of Polymer Chemistry.
CO3	Relate the principles of electrochemical reactions and corrosion.
CO4	Understand the concepts of energy devices and its engineering applications.
CO5	Understand the basics of Nano-chemistry and its applications.

BoS Chairman

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.

Reference Books	
1.	Friedrich Emich, “Engineering Chemistry”, Scientific International Pvt. Ltd., New Delhi, 2014.
2.	PrasantaRath, “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.

BoS Chairman

B.E / B.Tech	B19CST101 - PROBLEM SOLVING AND PROGRAMMING IN C (Common to Aero, Agri, BT and Mech)	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.

BoS Chairman

UNIT - V	STRUCTURES, UNIONS AND FILES	9
Structures and Unions : Defining a Structure – Processing a Structure – User defined data types (Type def) – Unions. **Files :** Opening and Closing a Data File – Reading and writing a data file – Processing adata 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 Mc Graw - 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. and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

BoS Chairman

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 engineeringfield.
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 orthographicviews.
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.		

BoS Chairman

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	Construct the basic engineering curves and freehand sketching of basic geometrical constructions and multiple views of objects.
CO2	Draw problems related toprojections of points, straight lines, planes and solids.
CO3	Build the projection of simple solids.
CO4	Apply the knowledge acquired on practical applications of sectioning and development of solids.
CO5	Construct simple solids and its sections in isometric view and projections and to draw its perspective views.

Text Books	
1.	N.D. Bhattand V.M. Panchal, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.

BoS Chairman

2.	K. Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International Publishers, 2017.

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

BoS Chairman

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 : 30

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	Understand 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.

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

BoS Chairman

B.E / B.Tech	B19CSP102 - PROBLEM SOLVING AND C PROGRAMMING LABORATORY (Common to Aero, Agri, BT and Mech)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To under stand the loops and decision-making statements to solve the problem.
2.	To develop the programs using one dimensional and two-dimensional arrays.
3.	Use functions to solve the given problem.
4.	To understand the pointers, structures and unions.
5.	To develop applications in Cusing file Operations.

List of Experiments	
Expt. No.	**Description of the Experiments**
1.	Writing algorithms, flow charts and pseudo codes for simple problems.
2.	Demonstrate expressions and conversions.
3.	Develop a C program by using if, if-else, switch and nested if statements.
4.	Construct a C Program by using while, do-while and for loops.
5.	Implement one dimensional array, passing arrays to functions and perform array operations insertion, deletion, searching.
6.	Implement two dimensional arrays and passing 2D arrays to functions.
7.	Develop a C Program to perform the String operation using build in methods and arrays.
8.	Construct a C program using function calls, recursion and call by value
9.	Generate a simple application using pointers, call by reference and pointers with arrays.
10.	Implement a C program using structures and unions.
11.	Write a C Program to perform the file operations and modes.
12.	Working with text files, random files and binary files.
	Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Build algorithms, flow charts and pseudo code for simple problems.
CO2	Develop a program using control structures.
CO3	Make use of arrays and strings.
CO4	Make use of functions and pointers.
CO5	Organize a heterogeneous data using structures, unions and files.

BoS Chairman

B.E / B.Tech	B19CEP101 - 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 environment.
CO2	Identify the vision and Goal towards success.
CO3	Build Values and Virtues to succeed in life.
CO4	Show focus in all activities
CO5	Develop knowledge to understand various kinds of people.

BoS Chairman

Semester - II

B.E / B.Tech	B19ENT201 - PROFESSIONAL ENGLISH (Common to all Branches)	T	P	TU	C
		2	0	1	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.

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	

BoS Chairman

Vocabularydevelopment	Vocabulary used in formal letters/emails and reports
Language development	British and American spelling, numerical adjectives.

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

BoS Chairman

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

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.

BoS Chairman

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.	The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
2.	To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
3.	The various methods of complex analysis can be used for efficiently solving the problems that occur in various branches of engineering disciplines.
4.	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 parallell opipeds).		

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.		

BoS Chairman

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	
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.

BoS Chairman

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.

BoS Chairman

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

Course Objectives	
1.	To make the students enhance the fundamental knowledge in 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.

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).

BoS Chairman

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.

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.

BoS Chairman

B.E / B.Tech	B19MET201 - ENGINEERING MECHANICS (Common to Mech, Aero, Agri)	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To make the students understand the vector and scalar representation of forces and the static equilibrium of particles.
2.	To understand the moment and the equilibrium of rigid bodies in two dimensions and three dimensions.
3.	To make the students understand the properties of surfaces and solidsin relation to moment of inertia.
4.	To understand laws of motion, kinetics of particles and their interrelationship.
5.	To make the students understandeffect of friction on equilibrium and the dynamic forces exerted in rigid bodies.

UNIT - I	STATICS OF PARTICLES	12

Introduction – Units and Dimensions – Laws of Mechanics – Principle of transmissibility – Lami's theorem, Parallelogram and triangular Law of forces – Coplanar Forces – rectangular components – Equivalent systems of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space using vector representation.

UNIT - II	EQUILIBRIUM OF RIGID BODIES	12

Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions.

UNIT - III	PROPERTIES OF SURFACES AND SOLIDS	12

Centroids and centre of mass – Centroids of lines and areas – T section, I section, Angle section and Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – T section, I section, Angle section and Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Mass moment of inertia for cylindrical and spherical solids from first principle.

BoS Chairman

UNIT - IV	DYNAMICS OF PARTICLES	12
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.		

UNIT - V	FRICTION AND RIGID BODY DYNAMICS	12
Friction force – Laws of sliding friction – Equilibrium analysis of simple systems with sliding friction, wedge friction – General Plane motion of simple rigid bodies such as cylinder and wheel.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Explain the basics and state of particles and understand the vectorial and scalar representation of forces and moments.
CO2	Interpret static equilibrium of particles and rigid bodies in two and three dimensions.
CO3	Identify the properties of surfaces & solids in relation to moment of inertia.
CO4	Illustrate the laws of motion, kinematics and kinetics of particles and their interrelationship.
CO5	Apply the effect of Friction and dynamics of rigid bodies on general plane motion.

Text Books	
1.	Vela Murali, "Engineering Mechanics", Oxford University Press,2010.
2.	Dr. Bansal, R.K. Sanjay Bansal, "Engineering Mechanics", Lakshmi publication Pvt. Ltd., 2016.

Reference Books	
1.	Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", McGraw- Hill Education (India) Pvt. Ltd. 10th Edition, 2013.
2.	Hibbeller, R.C., Engineering Mechanics: Statics and Dynamics, 13th Edition, Prentice Hall, 2013.
3.	Irving H. Shames, Engineering Mechanics - Statics and Dynamics, Pearson Education Asia Pvt. Ltd., 2011.
4.	Meriam JL and Craige, "Engineering Mechanics: statics and dynamics", John Willey and Sons publication 8th Edition, 2011.

BoS Chairman

B.E.	B19AGT201 – PRINCIPLES AND PRACTICES OF CROP PRODUCTION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the students about the principles and production practices of agricultural and horticulturalcrops.
2.	To impart the role of agricultural engineers with reference to various tillage crop management including croppingsystem.
3.	To provide general techniques underlying in quality enhancement ofcrops.
4.	To make them understand about maximizing cropproductivity.
5.	To gain wide knowledge on efficient production systems inHorticulture.

UNIT - I	AGRICULTURE AND CROP PRODUCTION	12

Introduction to Agriculture - Introduction to agriculture and its crop production sub-sectors - field crop production and Horticulture;

Factors affecting crop growth and production - Factors affecting crop growth and production: genetic (internal) and environmental (external) factors; Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices.

UNIT - II	CROP SELECTION AND ESTABLISHMENT	12

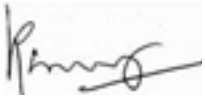
Cropping Systems - Regional and seasonal selection of crops; Systems of crop production; Competition among crop plants; Spacing and arrangement of crop plants;

Tillage Systems - Field preparation for crops including systems of tillage; Establishment of an adequate crop stand and ground cover including selection and treatment of seed, and nursery preparation.

UNIT - III	CROP MANAGEMENT	12

Water and Nutrient management - Crop water Management; Crop nutrition management - need for supplementation to soil nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling;

Pest and Disease management - Crop protection including management of weeds, pests and pathogens; Integrated methods of managing water, nutrients and plant protection; Types and Methods of harvest.



BoS Chairman

UNIT - IV	PRODUCTION PRACTICES OF AGRICULTURAL CROPS	12

Cultivation practices for Cereal & millet crops - Generalized management and cultivation practices for important groups of field crops in Tamil Nadu: Cereal crops - Rice, Wheat and Maize

Cultivation practices for Pulses - Green gram, Black gram, Red gram, Cowpea, Bengal gram, Soyabean

Cultivation practices foroil seed crops - Groundnut, Sesame, Sunflower, Safflower

Cultivation practices for Commercial crops – Cotton, Sugarcane, Jute

Cultivation practices for special purposecrops - Green manure and Fodder.

UNIT - V	PRODUCTION PRACTICES OF HORTICULTURAL CROPS	12

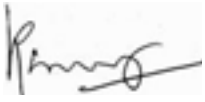
Cultivation practices for Fruit crops Important groups of horticultural crops in Tamil Nadu- Mango, Banana, Guava, Citrus, Pomegranate, Apple;

Cultivation practices Vegetable crops - Tomato, Onion, Cauliflower, Cabbage

Cultivation practices Flowers - Rose, Chrysanthemum, Gerbera; Orchids- Lily, Jasmine, Tuberose

Total Instructional hours : 45

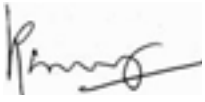
Course Outcomes : Students will be able to	
CO1	Students completing this course would have acquired knowledge on crop selection and crop production.
CO2	The students will have the required knowledge in the area of crop management practices of agricultural and horticultural crops with particular reference to tillage, seeds, weeds and nutrients.
CO3	Assess the crop growth and utilize the observations made toward constructing management strategy.
CO4	Synthesize and critically appraise management strategies to optimize yield and quality in field crop production.
CO5	Discuss about live cropping situations, principles and technologies that can be applied to in-crop situations to optimize returns within best practices in horticulture.



BoS Chairman

Text Books	
1.	Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, KrishiAnusandhanBhavan, Pusa, New Delhi, 2015.
2.	Reddy T. Sankara G.H. YellamandaReddi, Principles of Agronomy, Kalyani Publishers, New Delhi, 2005.
3.	Handbook of Agriculture. ICAR Publications, New Delhi, 2011.

Reference Books	
1.	Bose T. K. and L.P.Yadav. “Commercial Flowers”, Naya Prakash,Calcutta.1989.
2.	“Crop Production Guide”, Tamil Nadu Agricultural University Publication, Coimbatore,2005
3.	Kumar, N., Abdul Khader, M. Rangaswami, P. and Irulappan, I. “Introduction to spices, plantation crops, medicinal and aromatic plants”, RajalakshmiPublications, Nagercoil,1993.
4.	Kumar, N., “Introduction to Horticulture”, RajalakshmiPublications. Nagercoil, 7th edition, 2015.
5.	Shanmugavel, K.G. “Production Technology of Vegetable Crops”. Oxford India Publications, New Delhi,1989.



BoS Chairman

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 - மிருதங்கம், 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

Text - Cum - Reference Books

BoS Chairman

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.

BoS Chairman

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 (Any 8 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 : 30		

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.
CO3	Interpret 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 ltrasonic Interferometer.

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

BoS Chairman

B.E.	B19AGP201 – CROP HUSBANDRY LABOTATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To introduce the different crop production practices in wet land system
2.	To understand about the different crop production practices in dry land system
3.	To analyze the different crop production practices in garden land system

List of Experiments	
Expt. No.	**Description of the Experiments (Any 8 experiments)**
1.	Field preparation studies
2.	Seed selection and seed treatment procedures
3.	Seed bed and nursery preparation
4.	Sowing /Transplanting
5.	Biometric observation for crops
6.	Nutrient management studies
7.	Water management and irrigations scheduling
8.	Weed management studies
9.	Integrated Pest Management studies
10.	Harvesting

Course Outcomes : Students will able to	
CO1	The students will have the required knowledge in the Wetland crop production
CO2	The students will have the required knowledge in the Garden land crop production

BoS Chairman

CO3	The students will have the required knowledge in the Dry land crop production
CO4	Students completing this course would have acquired knowledge on crop selection, crop production and crop management.
CO5	Students completing this course would have acquired knowledge on crop protection

Text Books	
1.	Rajendra Prasad, "Text Book of Field Crop Production". Directorate of Information and Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi, 2015.
2.	"Handbook of Agricultur". ICAR Publications, New Delhi, 2011.

Reference Books	
1.	"Crop Production Guide", Tamil Nadu Agricultural University Publication, Coimbatore, 2005
2.	Kumar, N., "Introduction to Horticulture", Rajalakshmi Publications. Nagercoil, 7th edition, 2015.
3.	Shanmugavel, K.G. "Production Technology of Vegetable Crops". Oxford India Publications, New Delhi,1989.

List of Equipment Required

Sl. No.	Description of Equipment	Quantity
1.	A wet land / garden land for a minimum of 5 cents area for each / group of students	1
2.	An open / bore well as water source to support cultivation	1

BoS Chairman

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.

List of Experiments			
GROUP – A (CIVIL & MECHANICAL)			
I	Civil Engineering Practices		12
Plumbing and Carpentry Works			
1.	Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings.		
2.	Preparation of wooden joints by sawing, planning and cutting		
	i.	Planning & Polishing operation	
	ii.	Half lap joint	
	iii.	Cross lap joint	

II	Mechanical EngineeringPractices	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.	

BoS Chairman

Machine Shop	
1.	Drilling and Tapping
2.	Lathe Exercise – Facing operation
3.	Lathe Exercise – Straight turning and Chamfering
Sheet metal	
Making of small parts using sheet metal	
1.	Tray Funnel
2.	Funnel
Machine assembly practice and Demonstration	
1.	Machine assembly practiceon
2.	Study of centrifugal pump
3.	Study of air conditioner

GROUP – B (ELECTRICAL & ELECTRONICS)	**30**

Expt. No.	Description of the Experiments
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 & desoldering practices.
	Total Instructional hours : 60

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Explain the pipe connections and identify the various components used in plumbing.
CO2	Develop simple wooden joints using wood working tools and simple components using lathe and drilling machine.
CO3	Construct simple lap, butt and tee joints using arc welding equipment and simple parts using sheet metal.
CO4	Construct 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	Examine logic gates (AND, OR, EOR and NOT), Electronic components and equipment's.

BoS Chairman

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

Course Objectives	
1.	Enhance communication and problem solving skills
2.	Develop the inter personal skills
3.	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		

Course Outcomes : Students will be able to	
CO1	Develop the Interpersonal Skills
CO2	Show the creative skill in different aspects.

BoS Chairman

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.

BoS Chairman

Semester - III

B.E. - AGRI	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.

BoS Chairman

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.	B19AGT301 – SOIL PHYSICS AND MECHANICS	T	P	L	C
		3	0	0	3

Course Objectives	
1.	To create fundamental knowledge on Soil physical parameters, Permeability – Compaction, Bearing Capacity and types and methods of soil survey and interpretative groupings.
2.	To understand the different types of soil and they must able to prepare the survey reports.
3.	To remember soil compaction methods and phase relationship should be given to the students.
4.	To analyze and to measure the shear strength and other lab methods.
5.	To remember the bearing capacity of soil and its types.

UNIT - I	INTRODUCTION AND SOIL PHYSICS	9

Soil - definition - major components – Soil forming minerals and processes - soil profile - Physical properties - texture – density - porosity - consistence - colour - specific gravity - capillary and non-capillary - plasticity. Soil air - soil temperature – Infiltration - soil water - classification of soil water - Movement soil water - hydraulic conductivity. Soil colloids – organic and inorganic matter - Ion exchange - pH – Plant nutrient availability.

UNIT - II	SOIL CLASSIFICATION AND SURVEY	9

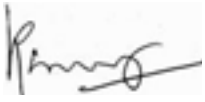
Soil taxonomy – Soils of Tamil Nadu and India. Soil survey - types and methods of soil survey – Field mapping - mapping units - base maps - preparation of survey reports - concepts and uses - land capability classes and subclasses - soil suitability - Problem soils – Reclamation.

UNIT - III	PHASE RELATIONSHIP AND SOIL COMPACTION	9

Phase relations - Gradation analysis - Atterberg Limits and Indices - Engineering Classification of soil – Soil compaction - factors affecting compaction - field and laboratory methods - flow net.

UNIT - IV	ENGINEERING PROPERTIES OF SOIL	9

Shear strength of cohesive and cohesionless - Mohr-Coulomb failure theory - Measurement of shear strength, direct shear, Triaxial and vane shear test - Permeability - Coefficient of Permeability - Darcy's law - field and lab methods - Assessment of seepage - flow net analysis - Compressibility.



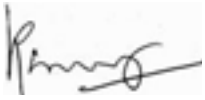
BoS Chairman

UNIT - V	BEARING CAPACITY AND SLOPE STABILITY	9
Bearing capacity of soils - Factors affecting Bearing Capacity - Shallow foundations - Terzaghi's formula - BIS standards - Slope stability - Analysis of infinite and finite slopes - friction circle method - slope protection measures.		
		Total Instructional hours : 45

Course Outcomes	
At the end of the course the student will be able to understand the following	
CO1	Fundamental knowledge of soil physical parameters.
CO2	The procedures involved in soil survey, soil classification.
CO3	The phase relationship and soil compaction.
CO4	Concepts of bearing capacity and slope stability.
CO5	Study about properties of soil.

Text Books	
1.	Nyle C. Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, 10th Edition, New York, 2008.
2.	Punmia, B.C., "Soil Mechanics and Foundation "Laxmi Publishers, New Delhi, 2007.

Reference Books	
1.	Edward J. Plaster., "Soil Science", Cengage Learning India Ltd, New Delhi, 2009.
2.	Arora,K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2007.
3.	Murthy, V.N.S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2007.
4.	Sehgal, S.B., "Text Book of Soil Mechanics", CBS Publishers and Distributors New Delhi, 2007.
5.	https://nptel.ac.in/courses/105/105/105105168/



BoS Chairman

B.E.	B19AGT302 - THEORY OF MACHINES	T	P	L	C
		2	0	1	3

Course Objectives	
1.	To understand about linkages, mechanisms and analyse the acceleration of any link at any position
2.	To learn the effect and utilization of friction in machines.
3.	To rememberthe cam and motion of types offollower.
4.	To apply the basics of toothed gearing and geartrains.
5.	To analyze the motion of fly wheel and balancing.

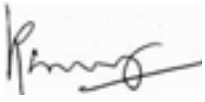
UNIT - I	TERMINOLOGY	9
Definitions - Kinematic links - Pairs - Chain - Machines and mechanism - Types and uses – Kinematic inversion of four bar chain and slider crank mechanism. Velocity and acceleration in simple mechanisms - Vector polygon and Acceleration Polygon – Four bar, single slider and Toggle Mechanism.		

UNIT - II	FRICTION AND APPLICATIONS	9
Sliding and rolling friction – friction in screw threads-Bearing and lubrication - Friction clutches - Belt drives - chain drives - Friction aspects in brakes.		

UNIT - III	MOTION OF CAM AND FOLLOWER	9
Cam and follower - types - application – displacement diagrams - profile layout for uniform velocity - Uniform acceleration and retardation - simple harmonic and cycloidal motion.		

UNIT - IV	GEARS AND GEAR TRAINS	9
Gears - classification - terminology - law of gearing - tooth profile - interference between rack and pinion. Gear trains – simple, compound, reverted. Simple epicyclic gear trains.		

UNIT - V	FLYWHEEL AND BALANCING	9
Inertia - turning moment - fluctuation of speed and energy. Balancing of rotating masses and reciprocating masses.		
		Total Instructional hours : 45

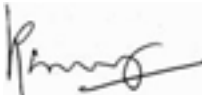


BoS Chairman

Course Outcomes	
CO1	Students can able to analyze the basic components and layout of linkages in the assembly of a system machine &analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
CO2	They able to analyze the basic concepts of the effects of friction in motion transmission and in machine components
CO3	They develop the motion of cam mechanisms for specified output motions.
CO4	They able to understand learn the basic functional concepts of toothed gearing and gear trains
CO5	They able to analyze the fundamental related to motion of flywheel balancing

Text Books	
1.	Rattan, S.S, Theory of Machines, 5th Edition, Tata McGraw-Hill,2019.
2.	Khurmi, R.S. and Gupta, J.K, Theory of machines, 14th Edition, S.Chand Publication House, 2010.

Reference Books	
1.	Thomas Beven, Theory of Machines, Pearson Education India, 2009.
2.	Ballaney, P.L, Theory of machines and Mechanisms, Khanna Publishers, New Delhi, 2003.
3.	https://nptel.ac.in/courses/115/103/115103115/



BoS Chairman

B.E.	B19AGT303 – SURVEYING AND LEVELLING	T	P	L	C
		3	0	0	3

Course Objectives	
1.	To understand the principle of surveying, various methods and applications to Agricultural Engineering projects.
2.	To remember the principles of compass surveyingand they should know the possible source of error occurs.
3.	To understand the theodolite and its types, Total station and GPStechnology.
4.	To create the contours and able to interpolate the contours.
5.	To apply capacities of reservoirs and earth work calculation.

UNIT - I	FUNDAMENTALS AND CHAIN SURVEYING	9

Definition - Classifications - Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting – applications - enlarging and reducing figures - Areas enclosed by straight lines - Irregular figures - digital Planimeter.

UNIT - II	COMPASS AND PLANE TABLE SURVEYING	9

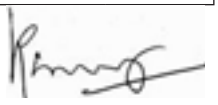
Compass – Basic principles - Types - Bearing – Systems and conversions – Sources of Errors - Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of closing error – applications - Plane table and its accessories - Merits and demerits - Radiation – Intersection- Resection – Traversing - sources of errors – applications.

UNIT - III	THE ODOLITE AND MODERN SURVEYING	9

Theodolite - Types - Description - Horizontal and vertical angles - Temporary and Permanent adjustments – Heights and distances – Tangential and Stadia Tacheometry – Subtense methods - Stadia constants - Anallactic lens - Traversing - Gale's table - Total Station - Global Positioning System (GPS).

UNIT - IV	LEVELLING	9

Level line - Horizontal line - Datum - Bench marks - Levels and staves - temporary and permanent adjustments – Methods of leveling - Fly levelling - Check levelling - Procedure in levelling - Booking - Reduction - Curvature and refraction - Reciprocal levelling - sources of errors in leveling - Precise levelling - Types of instruments - Adjustments – Field procedure - laser levelling.



BoS Chairman

UNIT - V	LEVELLING APPLICATIONS	9
Longitudinal and Cross - section - Plotting - Contouring - Methods – Characteristics and uses of contours - Plotting – Methods of interpolating contours – computation of cross sectional area and volumes - Earth work calculations - Capacity of reservoirs - Mass hauldiagrams		
		Total Instructional hours : 45

Course Outcomes	
CO1	Students are expected to use all surveying equipments.
CO2	Students are expected to prepare LS & CS, contour maps
CO3	Carryout surveying works related to land and civil engineering projects.
CO4	Solve errors during surveying and leveling
CO5	Develop skills about levelling and its applications

Text Books	
1.	James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001.
2.	Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.

Reference Books	
1.	S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2004.
2.	A.M. Chandra, Plane Surveying, New Age International Publishers 2002.
3.	Alak De, Plane Surveying, S. Chand & Company Ltd., 2000.
4.	https://nptel.ac.in/courses/105/107/105107122/

BoS Chairman

B.E.	B19MCT302 - INDIAN CONSTITUTION	T	P	TU	C
		3	0	0	-

UNIT - I	INTRODUCTION	9

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT - II	STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT	9

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT - III	STRUCTURE AND FUNCTION OF STATE GOVERNMENT	9

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT - IV	CONSTITUTION FUNCTIONS	9

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT - V	INDIAN SOCIETY	9

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Total Instructional hours : 45

Course Outcomes : Upon completion of the course, students will be able to	
CO1	Understand the functions of the Indian government
CO2	Understand and abide the rules of the Indian constitution

BoS Chairman

CO3	Understand function of state government
CO4	Understand constitution function
CO5	Understand Constitutional remedies for citizens.

Text Books	
1.	Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.
2.	R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi.
3.	Maciver and Page, “Society: An Introduction Analysis”, Mac Milan India Ltd., New Delhi.
4.	K.L. Sharma, (1997) “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi.

Reference Books	
1.	Sharma, Brij Kishore, “Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2.	U.R.Gahai, “Indian Political System”, New Academic Publishing House, Jalaendhar.
3.	R.N. Sharma, “Indian Social Problems”, Media Promoters and Publishers Pvt.Ltd.
4.	https://onlinecourses.nptel.ac.in/noc20_lw03/preview

BoS Chairman

B.E. / B.Tech.	B19HST301 - தமிழரும் தொழில்நுட்பமும்	T	P	TU	C
		1	0	0	1

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.ஃ.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

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
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.

BoS Chairman

B.E. / B.Tech.	B19HST301 - TAMILS AND TECHNOLOGY	T	P	TU	C
		1	0	0	1

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

BoS Chairman

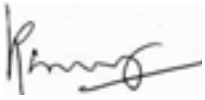
Text - Cum - Reference Books	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை 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 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.	B19AGP301 – SURVEYING AND LEVELLING LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To train the student to acquire skill in operation of various surveying and leveling instruments.
2.	To remember various compass surveying methods.
3.	To understand about the principles of plant table surveying.
4.	Students should able to measure horizontal and vertical angle using theodolite.
5.	Students should acquire practical knowledge on handling basic survey instruments including leveling and development of contour map of given area.

❍	**CHAIN SURVEYING**
Ranging, Chaining and Placing Chain traversing	
❍	**COMPASS SURVEYING**
Triangulation Problem Compass traversing	
❍	**PLANE TABLE SURVEYING**
Radiation Intersection - Triangulation problem Plane table traversing	
❍	**THEODOLITE SURVEYING**
Measurement of horizontal & vertical angles Tangential & Stadia Tacheometry	
❍	**LEVELLING**
Fly levelling using Dumpy level Fly levelling using Tilting level Check levelling Block levelling Radial Contouring	
❍	**DEMONSTRATION OFTOTAL**
❍	**STATION AND GPS OUTCOME**
Students completing this course would have acquired practical knowledge on handling basic survey instruments including leveling and development of contour map of given area.	



BoS Chairman

List of Equipment Required		
Sl. No.	**Description of Equipment**	**Quantity**
1.	Total Station	1Nos
2.	Theodolites	6 Nos
3.	Dumpy level / Filling level	6 Nos
4.	Pocket stereoscope	1
5.	Ranging rods	1 for a set of 5 students
6.	Levelling staff	
7.	Cross staff	
8.	Chains	
9.	Tapes	
10.	Arrows	
11.	Prismatic Compass	10 nos
12.	Surveyor Compass	2 nos
13.	Survey grade or Hand held GPS	1nos
		Total Instructional hours : 60

Course Outcomes : At the end of the course, student will able to understand the	
CO1	Practical skill on operation of survey instruments
CO2	Calculation of area of regular and irregular fields
CO3	Capacity of preparing LS,CS, contour maps and interpretation of contours
CO4	Required knowledge on land leveling applications for irrigation and soil conservation
CO5	Computation of volume of farm reservoirs like farm pond

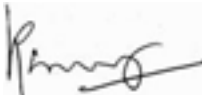
Reference Books	
1.	S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2004.
2.	Alak De, Plane Surveying, S. Chand & Company Ltd., 2000.

BoS Chairman

B.E.	B19AGP302 – SOIL PHYSICS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	Students should be able to verify various quality aspects of soil and water studied in theory by performing experiments in lab.
2.	Students should able to analyze the texture of soil and grain size distribution.
3.	Students are able to determine specific gravity, soil moisture, pH
4.	To develop skills on testing of infiltration of soils
5.	To evaluate leaching requirement of soil science

List of Equipment Required	
Expt. No.	**Description of Equipment**
1.	Identification of rocks and minerals
2.	Collection and processing of soil samples
3.	Determination of soil moisture, EC and Ph
4.	Field density determination by Core Cutter and Sand Replacement method
5.	Specific gravity determination by Pycnometer
6.	Textural analysis of soil by International Pipette method
7.	Grain size analysis by using Mechanical shaker
8.	Determination of Organic carbon
9.	Estimation of Gypsum requirements
10.	Determination of infiltration rate using double ring infiltrometer
11.	Estimation of leading requirement and zypsum for saline and sodic salt
	Total Instructional hours : 60



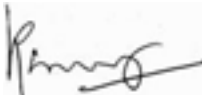
BoS Chairman

Course Outcomes : Students will able to	
CO1	Students know the techniques to determine various physical and chemical properties of soil applicable to agriculture and irrigation.
CO2	Students know the techniques to determine specific gravity, soil moisture, pH
CO3	Calculating gypsum requirement for problem soils
CO4	Estimation of organic carbon
CO5	Computation of leaching requirements for saline soils.

Text Books	
1.	Punmia, B.C, “Soil Mechanics and Foundation Engineering”, Laxmi Publishers, New Delhi 2007.
2.	Laboratory Manual, Centre for Water Resources, Anna University.
3.	https://nptel.ac.in/courses/105/103/105103097/

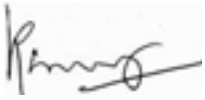
List of Equipment Required

Sl. No.	Description of Equipment	Quantity
1.	IgneousRock- (Any 4) Horneblende pegmatite, Horneblende granite, Serpentinite, Pink microceline granite, etc	1
2.	Sedimentary Rock- (Any 4) Miocene limestone, Traverine, Sandstone, Shale, Limestone, etc	1
3.	Metamorphic Rock-(Any 4) Calc silicate granulite, Marble, Garnet granulite, Garnet biotite gneiss, etc , Charnockite acidic with basic layering ,Hornblende biotite gneiss, Charnokite	1
4.	Minerals-(Any 4) Talc, Gypsum, Calcite. Fluorite, Apatite, Feldspar, Quartz, Topaz, Corundum, Pyrite, Asbestos, Chalk, Feldspar, Mica, Hornblende, etc	1
5.	Khurpi, Spade or Augers , Plastic bowl , Scale, Wooden roller, Mortar and pestle Polythene/paper/cloth bags, Labels, Aluminum tray	1



BoS Chairman

6.	Sampling tube/auger, Moisture cans , Balance with weights , oven or Desicator	1
7.	EC meter, potassium chloride, 100 ml beaker	1
8.	pH meter, buffer tablet pH 4.0, 7.0 or 9.2, 100 ml beaker	1
9.	Core sampler, aluminum tray, oven, balance upto 5 Kg, knife, spatula	1
10.	Sand pouring cylinder, Calibrating can, Metal tray with a central hole, Dry sand (passing through 600 micron sieve), Balance of capacity 15 kg, Moisture content bins, Glass plate, Metal tray, Scraper tool	1
11.	A pycnometer, an analytical balance, filter paper, clean and dry cloth	1
12.	ASTM Sieve-230 mm with lid, 2 mm sieve, sodium hexametaphosphate, 100 ml beaker 3nos, 1000 ml measuring cylinder, weighing balance of 0.01 g, glass rod and pipette 20 ml	1
13.	A sieve shaker, complete set of I.S Sieve sizes generally 4.75 mm, 2.00mm, 1.18 mm, 425microns, 300microns, 150 microns and 75 microns along with a pan and a lid, Balance of 0.01 g sensitivity	1
14.	500 ml conical flasks, Pipette, Burette, Potassium dichromate (K2Cr2O7), Ferrous sulfate heptahydrate (FeSO4.7 H2O), Sulfuric acid (H2SO4) concentrated, Diphenylamine indicator	1
15.	saturated calcum sulphate, Ammonium chloride-Ammonium hydroxide buffer, Erichrome black-T indicator, EDTA, mechanical shaker, whatman No. 3 filter paper,100 ml conical flasks, Pipette, Burette	1



BoS Chairman

B.E.	B19CEP301 - SOFT SKILLS - II (Common to all Branches)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To enhance communication skills through LSRW skills.
2.	To enrich interpersonal skills through integratedactivities.
3.	To develop social and professionaletiquette.
4.	To identify and apply employability skills for professionalsuccess.
5.	To remember corporate skills and work ethics.

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		

BoS Chairman

Course Outcomes : At the end of the course the student 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.
5.	https://nptel.ac.in/courses/109/107/109107121/

BoS Chairman

Semester - IV

B.E.	B19MAT403 – PROBABILITY AND STATISTICS	T	P	TU	C
		3	0	1	4

Course Objectives	
The aim of this course is to	
1.	Provide required skills to apply the statistical tools in engineering problems.
2.	Introduce the basic concepts of probability and random variables.
3.	Understand the basic concepts of two dimensional random variables.
4.	Acquaint the knowledge in testing of hypothesis for small and large samples with applications in real life problems.
5.	Expose to the basic concepts of classifications of design of experiments which apply in agriculture and statistical quality control.

UNIT - I	PROBABILITY AND DISTRIBUTIONS	12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT - II	TWO - DIMENSIONAL RANDOM VARIABLES	12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables – without proof).

UNIT - III	TESTING OF HYPOTHESIS	12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chisquare and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT - IV	DESIGN OF EXPERIMENTS	12

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

BoS Chairman

UNIT - V	STATISTICAL QUALITY CONTROL	12
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Interpret the fundamental knowledge of the concepts of probability and standard distributions.
CO2	Develop the basic concepts of one and two dimensional random variables and apply in engineering applications.
CO3	Demonstrate a solid understanding of testing of hypothesis.
CO4	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO5	Develop the sampling distributions and statistical quality control techniques used in engineering and management problems.

Text Books	
1.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2.	Milton. J.S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2009.

Reference Books	
1.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, 9th Edition, 2016.
2.	Papoulis. A. and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi,2017.
3.	Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier, 2014.
4.	Iyengar. T.K.V, Krishna Gandhi. B, Ranganthan .S and Prasad. M.V.S.S.N "Probability and Statistics", S. Chand Publications, Edition, 2017.
5.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2013.

BoS Chairman

B.E.	B19AGT401 – UNIT OPERATIONS IN AGRICULTURAL PROCESSING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamental knowledge in Evaporation, Filtration and Sedimentation.
2.	To learn various types of mechanical separation and size reduction equipments.
3.	To understand the various size reduction methods.
4.	To create the knowledge on contact equilibrium separation.
5.	To remember Processing, Sieve analysis, Crystallization and Distillation in processing of agricultural produce.

UNIT - I	EVAPORATION AND CONCENTRATION	9

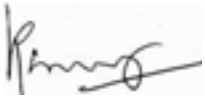
Unit operations in food processing – conservation of mass and energy – overall view of an engineering process - dimensions and units – dimensional and unit consistency – dimensionless ratios - evaporation – definition – liquid characteristics – single and multiple effect evaporation - performance of evaporators and boiling point elevation – capacity – economy and heat balance - types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator.

UNIT - II	MECHANICAL SEPARATION	9

Filtration – definition – filter media – types and requirements-constant rate filtration – constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press - sedimentation – gravitational sedimentation of particles in a fluid – Stoke‟ s law, sedimentation of particles in gas - cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid – liquid separation – centrifuge equipment.

UNIT - III	SIZE REDUCTION	9

Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger‟ s, Bond‟ s and Kick‟ s laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills – rolling compression mills - attrition, rod, ball and tube mills – construction and operation.



BoS Chairman

UNIT - IV	CONTACT EQUILIBRIUM SEPARATION	9

Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquidequilibrium - equilibrium concentration relationships – operating conditions - calculation of separation in contact – equilibrium processes - gas absorption – rate of gas absorption – stage – equilibrium gas – absorption equipment - properties of tower packing – types – construction – flow through packed towers - extraction – rate of extraction – stage equilibrium extraction - equipment for leaching coarse solids – intermediate solids – basket extractor - extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers - washing – equipments.

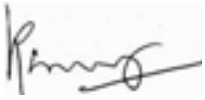
UNIT - V	CRYSTALLISATION AND DISTILLATION	9

Crystallization - Equilibrium – Rate of crystal growth stage - Equilibrium crystallization - Crystallizers - Equipment - Classification - Construction and operation – Crystallizers - Tank - Agitated batch - Swenson - Walker and Vacuum crystallizers - Distillation - Binary mixtures - Flash and differential distillation - Steam distillation – Theory - Continuous distillation with rectification – Vacuum distillation - Batch distillation - Operation and process - Advantages and limitation - Distillation equipments - Construction and operation - Factors influencing the operation.

Total Instructional hours : 45

Course Outcomes	
CO1	To understand fundamentals of various unit operations of Agricultural Processing.
CO2	To infer material handling equipments.
CO3	They are able to apply Rittinger‟ s, Bond‟ s and Kick‟ s laws for crushing.
CO4	To choose gas absorption and extraction.
CO5	To categorize crystallization, Distillation techniques and equipments.

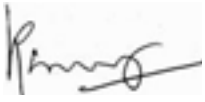
Text Books	
1.	Earle, R.L., “Unit operations in Food Processing”, Pergamon Press, Oxford, U.K, 1985.
2.	McCabe, W.L., and Smith, J.C., “Unit Operations of Chemical Engineering”, Mc-Graw-Hill Inc., Kosaido Printing Ltd., Tokyo, 1990.



BoS Chairman

3.	Geankoplis, C.J. “Transport Processes and Separation Process Principles”, 4th Edition, Prentice Hall, 2003.
4.	Sahay, K.M., and Singh, K.K. “Unit Operations of Agricultural Processing”, Vikas Publishing House, Pvt. Ltd., New Delhi, 1994.

Reference Books	
1.	Coulson, J.M and J.F. Richardson. Chemical Engineering. Volume I to V. The Pergamon Press. New York, 1999.
2.	Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press LLC, Florida, 2003.
3.	https://nptel.ac.in/courses/126/105/126105011/



BoS Chairman

B.E.	B19AGT402 – FLUID MECHANICS AND HYDRAULICS	T	P	TU	C
		2	0	1	3

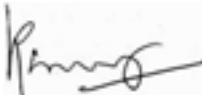
Course Objectives	
1.	To remember the students to the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static and dynamic conditions.
2.	To understand the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes.
3.	To apply various hydraulic engineering problems like open channel flows and hydraulic pumps. At the completion of the course, the student should be able to relate the theory and practice of problems in agricultural engineering
4.	To remember different types of flow channel and understand the flow measurements.
5.	To understand the dimensional analysis and different kinds of pumps and its working principles.

UNIT - I	PROPERTIES OF FLUIDS	12

Properties of fluids – definition – units of measurement - Mass density – specific weight, specific volume – specific gravity - equation of state – perfect gas - Viscosity – vapour pressure – compressibility and elasticity - surface tension – capillarity. Fluid pressure and measurement – simple, differential and micro manometers - Mechanical gauges – calibration. Hydrostatic forces on surfaces – total pressure and centre of pressure - Horizontal - vertical and inclined plane surface - Pressure diagram – total pressure on curved surface. Archimedes principles – buoyancymetacentre – metacentric height.

UNIT - II	FLUID FLOW ANALYSIS	12

Types of fluid flow – velocity and acceleration of a fluid particle - Rotational – irrotational circulation and vorticity - Flow pattern – stream line – equipotential line – stream tube path line – streak line – flow net – velocity potential – stream function. Principles of conservation of mass – energy – momentum – continuity equation in Cartesian co-ordinates - Euler's equation of motion.



BoS Chairman

UNIT - III	FLOW MEASUREMENT	12

Bernoulli's equation – applications - Venturimeter – orifice meter – nozzle meter - rotameter – elbow meter - pitot tube – Orifice – sharp edged orifice discharging free – submerged orifice – mouth piece - Flow through orifice under variable head – time of emptying a tank with and without inflow. Flow through pipes – laminar and turbulent flow in pipes - Reynold's experiment - Darcy – Weisbach equation for friction head loss – Chezy's formula – Manning's formula – Hazen- William's formula - Major and minor losses in pipes – hydraulic gradient line – energy gradient line. Siphon – water hammer in pipes – gradual and sudden closure of valves.

UNIT - IV	OPEN CHANNEL FLOW	12

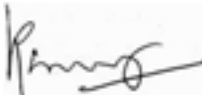
Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. Specific energy and critical depth - momentum in open channel flow – specific force – critical flow – computation. Flow measurement in channels – notches – rectangular, Cipolletti and triangular – float method - Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume.

UNIT - V	DIMENSIONAL ANALYSIS & PUMPS	12

Dimensional analysis – Fundamental dimensions – dimensional homogeneity – Rayleigh's method and Buckingham Pi-Theorem - concept of geometric, kinematic and dynamic similarity. Important non dimensional numbers – Reynolds, Froude, Euler, Mach and Weber - Pump terminology – suction lift, suction head, delivery head, discharge, water horse power – selection of pump capacity. Centrifugal pumps – components – working – types of pumps and impellers - Priming – cavitation – specific speed – characteristic curves. Turbine and submersible pumps - Jet pump – jet assembly - Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump - Hydraulic ram.

Total Instructional hours : 60

Course Outcomes	
CO1	The students will be able to get a basic understanding of fluids in static, kinematic and dynamic equilibrium.
CO2	They will also infer the knowledge of the applicability of physical laws in addressing problems in hydraulics.

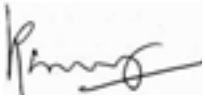


BoS Chairman

CO3	Students able to apply problems based on Chezy's formula – Manning's formula.
CO4	They will be able to make use of most economical section of channel.
CO5	The students will be able to analyze the dimensional principles and get a basic knowledge of types of pumps and impellers.

Text Books	
1.	Modi, P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Publishers Distributors, New Delhi, 2010.
2.	Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi Publications (P) Ltd., New Delhi, 2002.
3.	Jagdish Lal,. Hydraulic Machines. Metropolitan Book House, New Delhi, 2000.

Reference Books	
1.	Garde, R.J., Fluid Mechanics through problems. New Age International Publishers (P) Ltd., New Delhi, 2002.
2.	Michael A.M. and S.D. Khepar, Water Well and Pump Engineering. Tata McGraw Hill Co, New Delhi, 2005.
3.	Michael A.M. Irrigation Theory and Practice, Vikas Publishing House, New Delhi, 2008.
4.	https://nptel.ac.in/courses/112/105/112105269/



BoS Chairman

B.E.	B19AGT403 - THERMODYNAMICS AND HEAT TRANSFER	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To understand the basic laws of thermodynamics and heat transfer.
2.	To understand the principle of first and second law of thermodynamics.
3.	To understand the various engines.
4.	To create the knowledge in heat transfer in conduction mode.
5.	To learn the basics of convection and radiation.

UNIT - I	BASIC CONCEPTS OF THERMODYNAMICS	12

Thermodynamics and Energy – Systems – Types and properties - State and Equilibrium - Processes and Cycles – Forms of Energy – Temperature and Zeroth law of Thermodynamics – Internal energy – Enthalpy – Energy transfer by Heat, Work and Mass – Applications.

UNIT - II	FIRST AND SECOND LAW OF THERMODYNAMICS	12

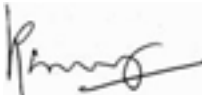
First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Un steady flow processes Second law of Thermodynamics – Entropy – Carnot principles.

UNIT - III	HEAT ENGINES	12

Internal Combustion Engines – C.I and S.I Engines – Four Stroke and Two Stroke Engines – Gas Turbines - Boilers – Fire Tube Boiler & Water Tube Boilers , Boiler Accessories and Components. Turbines – Impulse Turbine and Reaction Turbine, Refrigeration Cycle – Vapour Compression &Vapour Absorption System – Air Conditioning.

UNIT - IV	HEAT TRANSFER - CONDUCTION	12

General Differential equation of Heat Conduction - One Dimensional Steady State Heat Conduction – plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces.



BoS Chairman

UNIT - V	HEAT TRANSFER - CONVECTION AND RADIATION	9
Free and Forced Convection during external flow over Plates, Heat Exchanger Types – Overall Heat Transfer Coefficient – LMTD method – NTU method.Radiation – Black Body, Grey Body Radiation.		
		Total Instructional hours : 60

Course Outcomes	
CO1	The students can able to understand different gas power cycles and use them in IC engines.
CO2	The students will be able torelate the Thermodynamics principles and entropy.
CO3	The students will be able to understandtheFour Stroke and Two Stroke Engines Turbines.
CO4	They will be able to apply Dalton's law and Gibbs.
CO5	The students can able to solvefree convection and forced convection.

Text Books	
1.	Yunus A. Cengel and Michael A. Boles, "Thermodynamics: An Engineering Approach", Fourth Edition, Tata McGraw-hill, 2004.
2.	Michael J.Moran, Howard N.Shapiro, "Fundamentals of Engineering Thermodynamics", Fourth Editon, John wiley & Sons, 2000.
3.	Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.

Reference Books	
1.	R.K.Rajput, "A Text book of Engineering Thermodynamics", Third Edition, Laxmi publication (P) Ltd., 2007.
2.	Nag.P.K., "Engineering Thermodynamics", Third Edition, Tata McGraw hill, 2005.
3.	Domkundwar.S.,C.P.Kothandaraman "A course in Thermal engineering", Fifth Edition, Dhanpatrai & co (p) Ltd, 2000.
4.	Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
5.	https://nptel.ac.in/courses/127/106/127106135/

BoS Chairman

B.E.	B19AGT404 – STRENGTH OF MATERIALS	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To understand the stresses developed in bars and compounds bars.
2.	To understand analysis of plane trusses.
3.	To analyses the Transverse loading and stresses in beam.
4.	To create the knowledge on torsion.
5.	To learn the deflection of beams.

UNIT - I	STRESS, STRAIN AND DEFORMATION OF SOLIDS	12

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains - Thin shells - circumferential and longitudinal stresses in thin cylinders - deformation of thin cylinder – stresses in spherical shells – Deformation of spherical shells.

UNIT - II	ANALYSIS OF PLANE TRUSSES	12

Determinate and indeterminate plane trusses – determination of member forces by method of joints, method of sections and method of tension coefficient.

UNIT - III	TRANSVERSE LOADING AND STRESSES IN BEAM	12

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over-hanging beams. Theory of simple bending – bending stress distribution – Shear stress distribution - Flitched beams – carriage springs.

UNIT - IV	TORSION	12

Torsion formula - stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs - carriage springs.

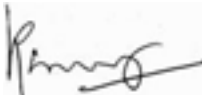
BoS Chairman

UNIT - V	DEFLECTION OF BEAMS	9
Computation of slopes and deflections in determinate beams - Double Integration method – Macaulay"s method – Area moment method – Conjugate beam method.		
		Total Instructional hours : 60

Course Outcomes	
CO1	The students can able to understand mathematical knowledge to calculate the deformation behavior of simple structures.
CO2	Critically solve the problems related to structural elements anddevelop the deformation behavior for different types of loads.
CO3	Students will be able to solveShear force and bending moment in beams.
CO4	The students will utilize the knowledge aboutstresses and deformation in circular and hollows shafts.
CO5	Students will be able to analyzeDouble Integration method – Macaulay"s method.

Text Books	
1.	Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2.	Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

Reference Books	
1.	Egor. P.Popov “Engineering Mechanics of Solids” Prentice Hall of India, New Delhi, 2001
2.	Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3.	Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4.	Ferdinand P. Been, Russell Johnson, J.R. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2005.
5.	https://nptel.ac.in/courses/112/106/112106141/

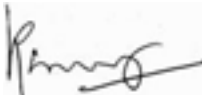


BoS Chairman

B.E.	B19AGP401 – FLUID MECHANICS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	Students should be able to understand the principles studied in theory by performing the experiments in lab.
2.	To understand the working principle of flow measuring instrument in pipes.
3.	To develop the skill on flow measurement in pipes and channels.
4.	To remember the flow losses in field channels.
5.	To understand the characteristics of agricultural pumps.

List of Experiments		
Expt. No.	**Description of the Experiments (Any 8 experiments)**	
1.	**Flow Measurement**	
	❍	Calibration ofRotameter
	❍	Flow throughVenturimeter
	❍	Flow through a circularOrifice
	❍	Determination of mean velocity by Pitottube
	❍	Flow through a TriangularNotch (Field)
	❍	Flow through a RectangularNotch (Field)
2.	**Losses inPipes**	
	❍	Determination of friction coefficient in pipes
	❍	Determination of losses due to bends, fittings and elbows
3.	**Pumps**	
	❍	Characteristics of Centrifugal pump
	❍	Characteristics of Submersible pump
	❍	Characteristics of Reciprocating pump
Total Instructional hours : 60		



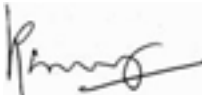
BoS Chairman

Course Outcomes	
CO1	The students will be able to demonstrate the measure of flow in pipes.
CO2	To experiment with the frictional losses in pipe.
CO3	The students will be able to examinethe measure of flow in open channels.
CO4	The students will be able to analyze the characteristics of pumps.
CO5	The students will be able to categorize the characteristics of turbines.

Text Books	
1.	Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004.
2.	Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House, New Delhi, 2000.
3.	Subramanya, K. Flow in Open Channels, Tata McGraw - Hill Pub.Co.1992.
4.	Subramanya, K. Fluid Mechanics, Tata McGraw- Hill Pub. Co., New Delhi,1992.

List of Equipment Required

Sl. No.	Description of Equipment	Quantity
1.	Rotameter	1
2.	Venturimeter	1
3.	Orificemeter	1
4.	Pitot tube	1
5.	Bernoulli"stherorem apparatus	1
6.	Triangular notch and Rectangular notch	1
7.	Coefficient of friction apparatus	1
8.	Pipe setup with bends, fittings and elbows for estimating minor losses	1
9.	Centrifugal pump, Reciprocating pump, Submersible pump, Jet pump	1
10.	Collecting tank, Stop watch	1



BoS Chairman

B.E.	B19AGP402 – STRENGTH OF MATERIALS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To create the students to the testing of different materials under the action of various forces.
2.	To remember determination of their strength characteristics experimentally.
3.	To test beams and various types of springs.
4.	To understand the hardness of metals
5.	To understand the deflection on metal beams

List of Experiments

Expt. No.	Description of the Experiments
1.	Tension test on steel rod
2.	Compression test on wood
3.	Double shear test on metal
4.	Torsion test on mild steel rod
5.	Impact test on metal specimen (Izod and Charpy)
6.	Hardness test on metals (Rockwell and Brinell Hardness Tests)
7.	Deflection test on metal beam
8.	Compression test on helical spring
9.	Deflection test on carriage spring
	Total Instructional hours : 60

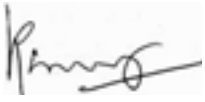
BoS Chairman

Course Outcomes	
CO1	The students will build the knowledge in the area of testing of materials and components of structural elements experimentally.
CO2	The students will utilize the required knowledge in the area of deflection and compression test on springs.
CO3	Students will utilize the required knowledge on impact on metals.
CO4	Studentsclassify the hardness on metals.
CO5	Students will be able todistinguish the deflection on metal beams.

Text Books	
1.	Strength of Materials Laboratory Manual, Anna University, Chennai - 600 025.
2.	IS1786-2008 (Fourth Revision, Reaffirmed 2013), 'High strength deformed bars and wires.

List of Equipment Required

Sl. No.	Description of Equipment	Quantity Required
1.	UTM of minimum 400 kN capacity	1
2.	Torsion testing machine	1
3.	Izod impact testing machine	1
4.	Hardness testing machine Rockwell Vicker's Brinnel } (any 2)	1 each
5.	Beam deflection test apparatus	1
6.	Extensometer	1
7.	Compressometer	1
8.	Dial gauges	Few
9.	Le Chatelier's apparatus	2
10.	Vicat's apparatus	2
11.	Mortar cube moulds	10



BoS Chairman

B.E. / B.TECH	B19MCT301- ENVIRONMENTAL SCIENCES (Common to all Branches)	T	P	TU	C
		3	0	0	3

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.

UNIT - I	ENVIRONMENT, ECO SYSTEMS AND BIODIVERSITY	9

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, 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) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

BoS Chairman

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 of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: 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 of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document 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 – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; 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 of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation - central and state pollution 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 child welfare – role of information technology in environment and human health – Case studies.

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Basic concepts of environment, ecosystem and biodiversity.
CO2	Different types of pollution and their control measures.

BoS Chairman

CO3	Various natural resources.
CO4	Development and improvement in standard of living that has lead to serious environmental disasters.
CO5	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

BoS Chairman

B.E.	B19CEP401 – CAREER ABILITY COURSE - I	T	P	TU	C
		0	2	0	1

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		

BoS Chairman

Semester - V

B.E.	B19AGT501 – FARM TRACTORS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the students to understand the different systems and working principles of tractor.
2.	To learn the students about different engine system of farm equipments.
3.	To understand various type of Transmission systems.
4.	To remember the basic hydraulic systems applied in tractors.
5.	To create knowledge about power tiller, makes of tractors and power tillers.

UNIT - I	TRACTORS	9

Classification of tractors - Tractor engines – construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft – firing order combustion chambers.

UNIT - II	ENGINE SYSTEMS	9

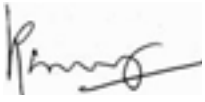
Valves-inlet and outlet valves – valve timing diagram. Air cleaner - exhaust – silencer. Cooling systems - lubricating systems - fuel system – governor - electrical system.

UNIT - III	TRANSMISSION SYSTEMS	9

Transmission - clutch - gear box - sliding mesh - constant mesh - synchro mesh. Differential, final drive and wheels. Steering geometry - steering systems - front axle and wheel alignment. Brake - types - system.

UNIT - IV	HYDRAULIC SYSTEMS	9

Hydraulic system - working principles, three point linkage - draft control - weight transfer, theory of traction - tractive efficiency – tractor chassis mechanics - stability - longitudinal and lateral. Controls - visibility - operatorsseat.



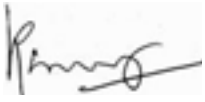
BoS Chairman

UNIT - V	POWER TILLER, BULLDOZER AND TRACTOR TESTING	9
Power tiller - special features - clutch - gear box - steering and brake. Makes of tractors, power tillers and bulldozers. Bulldozer - salient features – turning mechanism, track mechanism, components – operations performed by bulldozers. Types of tests - test procedure - need for testing & evaluation of farm tractor - Test code for performance testing of tractors and powertillers.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	The students will be able to understand the various equipment's and mechanizations used in the farm.
CO2	The students will infer the knowledge on earth moving machineries, tractor classification and tillage implements.
CO3	The students will understand the principles of transmission system of equipments.
CO4	The students will infer the knowledge on hydraulic system in equipments.
CO5	The students will apply hands on exercise on tractor testing

Text Books	
1.	Jain, S.C. and C.R. Rai. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi, 1999.
2.	Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.

Reference Books	
1.	Domkundwar A.V.A course in internal combustion engines. Dhanpat Rai & Co. (P) Ltd., Educational and Technical Publishers, Delhi,1999.
2.	Black, P.O. Diesel engine manual. Taraporevala Sons & Co., Mumbai,1996.
3.	Grouse, W.H. and Anglin, D.L. Automative mechanics. Macmillan McGraw Hill, Singapore, Indian Standard Codes for Agricultural Implements Published by ISI, New Delhi, 1993.
4.	Jagadeeshwar Sahay, Elements of Agricultural Engineering, Standard Publishers Co., New Delhi, 2010.
5.	https://nptel.ac.in/courses/126/105/126105009/



BoS Chairman

B.E.	B19AGT502 - FARM MACHINERY AND EQUIPMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the working principles of farm equipments, tillage implements.
2.	To remember farm mechanization benefits and constraints, identification of components of primary and secondary tillage implements.
3.	To create knowledge to the students about weeding and plant protection equipments.
4.	To evaluate about plant protection equipment.
5.	To create the knowledge on harvesting machinery.

UNIT - I	FARM MECHANIZATION	9

Farm mechanisation – objectives. Tillage - objectives - methods – primary tillage implements - secondary tillage implements - animal drawn ploughs - construction. Types of farm implements – trailed, mounted . Field capacity - forces acting on tillage tool.

UNIT - II	PRIMARY AND SECONDARY TILLAGE 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.

UNIT - III	SOWING AND FERTILIZING EQUIPMENT	9

Crop planting - methods - row crop planting systems - Devices for metering seeds – furrow openers – furrow closers- types – Types of seed drills and planters – calibration-fertilizer metering devices - seed cum fertilizer drills – paddy transplanters – nursery tray machines.

BoS Chairman

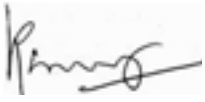
UNIT - IV	WEEDING AND PLANTPROTECTION EQUIPMENT	9
Weeding equipment – hand hoe – long handled weeding tools – dryland star weeder – wetland conoweeder and rotary weeder – Engine operated and tractor weeders. Sprayers – types - classification – methods of atomization, spray application rate, droplet size determination – volume median diameter, numerical median diameter – drift control.		

UNIT - V	HARVESTING MACHINERY	9
Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder combine harvesters, balers, threshers, tractor on top combine harvester, combine losses.		
	Total Instructional hours : 45	

Course Outcomes : Students will be able to	
CO1	The students will be able to understand the knowledge infarm mechanization and various equipment's used in field operations.
CO2	They relate the difference between primary and secondary tillage implements.
CO3	They are able to interpret different process of Fertilizing equipment.
CO4	Students will able to choose weeding and plant protection equipment.
CO5	They able to utilize the basic principles of harvesting machinery.

Text Books	
1.	Jagdishwar Sahay, Elements of Agricultural Engineering, Standard Publishers Distributors, Delhi 6, 2010.
2.	Michael and Ohja, Principles of Agricultural Engineering, Jain brothers, New Delhi, 2005

Reference Books	
1.	Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi 99, 1997.
2.	Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi., 1996.
3.	Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.



BoS Chairman

B.E.	B19AGT503 - POST HARVEST TECHNOLOGY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	The understand the fundamental knowledge in engineering properties of agricultural materials.
2.	To learn the fundamentals of psychrometry and drying.
3.	The remember Post Harvest cleaning & grading methods of harvested crops and storage of crops.
4.	To understand the shelling & handling process in post harvest Technology.
5.	To create knowledge on different crop processing.

UNIT - I	FUNDAMENTALS OF POST HARVESTING	9

Post harvest technology – introduction – objectives – post harvest losses of cereals, pulses and oilseeds – importance - optimum stage of harvest. Threshing – traditional methods mechanical threshers – types - principles and operation - moisture content – measurement – direct and indirect methods – moisture meters – equilibrium moisture content.

UNIT - II	PSYCHROMETRY AND DRYING	9

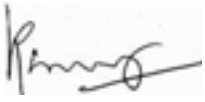
Psychrometry – importance – Psychrometric charts and its uses – Drying – principles and theory of drying – thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers.

UNIT - III	CLEANING AND GRADING	9

Principles - air screen cleaners – adjustments - cylinder separator - spiral separator – magnetic separator - colour sorter - inclined belt separator – length separators - effectiveness of separation and performance index.

UNIT - IV	SHELLING AND HANDLING	9

Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator – castor sheller – material handling – belt conveyor –screw conveyor – chain conveyor – bucket elevators – pneumatic conveying.



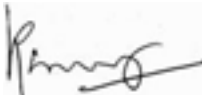
BoS Chairman

UNIT - V	CROP PROCESSING	9
Paddy processing – parboiling of paddy – methods – merits and demerits – dehusking of paddy – methods – merits and demerits – rice polishers –types – constructional details – polishing – layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing – millets processing.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Students will be able to understand the practical on: Material handling equipments.
CO2	They are able to classify thePost Harvest operations and processing methods of harvested crops.
CO3	They are able to infer the fundamentals of various unit operations of Agricultural Processing.
CO4	They are able to summarize the shelling and handling of different equipments.
CO5	They will be able to make use of crop processing methods of different crops.

Text Books	
1.	Chakraverty, A.Post harvest technology for Cereals, Pulses and oilseeds. Oxford & IBH publication Pvt Ltd, New Delhi, Third Edition,2000.
2.	Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi,1994.

Reference Books	
1.	Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.
2.	Henderson, S.M. and R.L. Perry, Agricultural Process Engineering. John Wiley and Sons, New York.1955.



BoS Chairman

Professional Elective - I

B.E.	B19AGE501 - HYDROLOGY AND WATER RESOURCES ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To learn about the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.
2.	To create the knowledge about run off and hydrograph.
3.	To understand the basics of flood & drought.
4.	To learn about the different reservoirs.
5.	To acquire the knowledge on Ground water Management.

UNIT - I	PRECIPITATION AND ABSTRACTIONS	10

Hydrological cycle - Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen and Isohyetal methods - Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression - Infiltration - Horton's equation - double ring infiltrometer, infiltration indices.

UNIT - II	RUN OFF	8

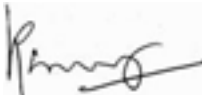
Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange's table and SCS methods – Stage discharge relationships - flow measurements - Hydrograph – Unit Hydrograph – IUH.

UNIT - III	FLOOD AND DROUGHT	9

Natural Disasters - Flood Estimation - Frequency analysis - Flood control - Definitions of droughts - Meteorological, hydrological and agricultural droughts - IMD method - NDVI analysis - Drought Prone Area Programme (DPAP).

UNIT - IV	RESERVOIRS	8

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area capacity - storage estimation, sedimentation - life of reservoirs – rule curve.



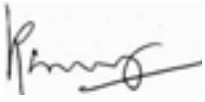
BoS Chairman

UNIT - V	GROUND WATER AND MANAGEMENT	10
Origin - Classification and types - properties of aquifers - governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Students will be understand the key drivers on water resources, hydrological processes and their integrated behavior in catchments.
CO2	They are able to apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge.
CO3	Students will able to solve the modeling of spatial analysis of rainfall data.
CO4	They are able to analyze the design of water storage reservoirs.
CO5	Students will able to distinguish the concept and methods of ground water management.

Text Books	
1.	Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010.
2.	Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.
3.	Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

Reference Books	
1.	David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007.
2.	VenTe Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3.	Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.



BoS Chairman

B.E.	B19AGE502 - SYSTEMS ANALYSIS AND SOFT COMPUTING IN AGRICULTURAL ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the students to the application of systems concept to agricultural engineering problems, planning and management.
2.	To understand the linear &Dynamic programming applied in agriculture.
3.	To acquire the knowledge on different simulation methods for agriculture engineering.
4.	To learn the neural networks application in agriculture engineering.
5.	To understand the basics of fuzzy logic and genetic algorithm applications.

UNIT - I	SYSTEM CONCEPTS	9
Definition, classification and characteristics of systems – Scope and steps in systems engineering – Need for systems approach to water resources and irrigation.		

UNIT - II	LINEAR PROGRAMMING	8
Introduction to operations research – Linear programming, problem formulation, graphical solution by simplex method – Sensitivity analysis.		

UNIT - III	DYNAMIC PROGRAMMING	9
Dynamic Programming – Concepts – Problem formulation – Optimal solution – Applications in Agriculture Engineering problems.		

UNIT - IV	SIMULATION	9
Basic principles and concepts – Random variate and random process – Monte Carlo techniques – Model development – Inputs and outputs – Deterministic and stochastic simulation – Irrigation Scheduling - application.		

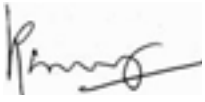
UNIT - V	NEURAL NETWORKS & FUZZY LOGIC	9
Neuron, Nerve structure and synapse, Artificial Neuron and its model, Neural network architecture: networks, Various learning techniques - Basic concepts of fuzzy logic, Fuzzy set theory and operations, Properties of fuzzy sets, Membership functions, interference in fuzzy logic and applications.		
Total Instructional hours : 45		

BoS Chairman

Course Outcomes	
CO1	The student will have the knowledge on system concepts and will be able to apply the optimization techniques like LP, DP.
CO2	They are able to acquire knowledge on simulation modelling in agricultural engineering.
CO3	They are able to apply ANN in agricultural applications.
CO4	They are able to understand fuzzy logic concepts in agriculture and irrigation.
CO5	Students will have knowledge in Genetic Algorithm and it's working principles.

Text Books	
1.	Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.
2.	Robert M Peart and W David Shoup, Agricultural Systems Management – Optimizing efficiency and performance, CRC Press, 2013.
3.	Gupta, P.K., and Man Mohan, “Problems in Operations Research”, (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.

Reference Books	
1.	Chaturvedidi, M.C., “Water Resources Systems Planning and Management”, Tata McGraw Hill, New Delhi, 1997.
2.	Taha, H.A., “Operations Research”, McMillan Publication Co., New York, 1995.
3.	Hiller, F.S., and Liebermann, G.J., “Operations Research”, CBS Publications and Distributions, New Delhi, 1992.
4.	Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
5.	S. Rajsekaran & G.A. VijayalakshmiPai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.



BoS Chairman

B.E.	B19AGE503 – IT IN AGRICULTURAL SYSTEMS	T	P	TU	C
		3	0	0	3

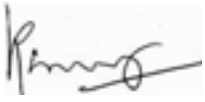
Course Objectives	
1.	To introduce the students to areas of agricultural systems in which IT and computers play a major role.
2.	To remember IT applications in precision farming, environmental control systems.
3.	To understand knowledge onagricultural systems management and weather prediction models.
4.	To apply various Decision support system in Agricultural process.
5.	To understand different e-governance systems in agriculture.

UNIT - I	PRECISION FARMING	9
Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.		

UNIT - II	ENVIRONMENT CONTROL SYSTEMS	9
Artificial light systems, management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.		

UNIT - III	AGRICULTURAL SYSTEMS MANAGEMENT	9
Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.		

UNIT - IV	AGRICULTURAL DECISION SUPPORT SYSTEMS	9
Expert systems, decision support systems and Agricultural and biological databases – GIS based Data management System – Different Data Structures in GIS		



BoS Chairman

UNIT - V	E-GOVERNANCE IN AGRICULTURAL SYSTEMS	9
E-commerce, e-business systems & applications, Technology enhanced learning systems and solutions, e-learning, Rural development and information society.		
		Total Instructional hours : 45

Course Outcomes	
CO1	The students shall be able to understand the IT applications in environmental control systems.
CO2	The students have understand about precision farming in agricultural system.
CO3	They understand the concept and methods of agricultural system management.
CO4	Students can able to maintain Agricultural database management system.
CO5	Students will apply the Hands on exercise on E-GOVERNENCE in agriculture system.

Text Books	
1.	National Research Council, "Precision Agriculture in the 21st Century", National Academies Press, Canada, 1997.
2.	H. Krug, Liebig, H.P. "International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation", 1989.

Reference Books	
1.	Peart, R.M., and Shoup, W.D., "Agricultural Systems Management", Marcel Dekker, New York, 2004.
2.	Hammer, G.L., Nicholls, N., and Mitchell, C., "Applications of Seasonal Climate", Springer, Germany, 2000.

BoS Chairman

B.E.	B19AGE504 – AGRICULTURAL WASTE MANAGEMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart knowledge to students on various methods of agricultural waste management for eco-friendly energy and manure production.
2.	To create knowledge on composting methods & applications.
3.	To learn about the biomass briquetting techniques.
4.	To understand the methods of biochar production
5.	To remember knowledge on biogas & ethanol production.

UNIT - I	INTRODUCTION	7

Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics - its recycling and utilization potential - current constraints in collection and handling of agricultural wastes – its environmental impact.

UNIT - II	COMPOSTING	10

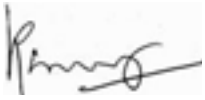
Definition - Solid waste suitable for composting – Methods of composting - vermicomposting - Mineralization process in composting - Biochemistry of composting – Factors involved – Infrastructure required – maturity parameters – value addition – application methods.

UNIT - III	BIOMASS BRIQUETTING	9

Definition – potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant - appliances for biomass briquettes.

UNIT - IV	BIOCHAR PRODUCTION	9

Definition - characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration.



BoS Chairman

UNIT - V	BIOGAS AND BIO ETHANOL PRODUCTION	10
Screening of suitable lingo cellulosic substrate for biogas production - determination of bio-energy potential of agro-waste by estimating total solids - volatile solids - Calorific value- per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio-digestion – types of digesters – factors affecting - nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes - Processing of Biomass to Ethanol – pre-treatment fermentation distillation.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Student will be able to understand various eco-friendly methods for agricultural waste management.
CO2	They remember nutritive value and energy production potential of agro wastes.
CO3	They understand the production technology of different byproducts of waste.
CO4	They able to create Biochar production technology.
CO5	They understand the principles of Biogas and bioethanol production methods.

Text Books	
1.	Raymond,C, Loehr,"Agricultural Waste Management - problems, processes and approaches". First edition, Academic press, 1974.
2.	Diaz,I.F.,M. de Bertoldi and W. Bidlingmaier. 2007. Compost science and technology, Elsevier pub., PP.1-380.
3.	UtaKrogmann, Ina Körne and Luis F. Diaz.2010. Solid waste technology and management (Vol 1 and2). Blackwel Pub Ltd., Wiley Online library.
4.	Yong Sik Ok, Sophie M. Uchimiya, Scott X. Chang, Nanthi Bolan.," Biochar-production characterization and applications". 2015. CRC press.

BoS Chairman

Reference Books	
1.	P.D. Grover & S.K. Mishra, “Biomass Briquetting: Technology and Practices”. Published by FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand, 1996.
2.	Magdalena Muradinand ZenonFoltynowicz, “Potential for Producing Biogas from Agricultural Waste in Rural Plants in Poland”. Sustainability, 2014, 6, 5065-5074.
3.	Biochar production from agricultural wastes via low-temperature microwave carbonization.
4.	Qian Kang, LiseAppels, Tianwei Tan and RafDewil, “Bioethanol from Lignocellulosic Biomass: Current Findings Determine Research Priorities” The Scientific World Journal, 2014, Article ID 298153, 13 pages.

BoS Chairman

Open Elective - I

B.E.	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	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.

BoS Chairman

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).

BoS Chairman

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.		

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.

BoS Chairman

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 DBMS (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

BoS Chairman

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 (4th 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.

BoS Chairman

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.

BoS Chairman

B.E. / B.TECH	B19EEO501 - ROTATING MACHINES AND TRANSFORMERS (Common to all Except EEE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impact knowledge on magnetic-circuit analysis and introduce magnetic materials.
2.	To understand the Working principles of DC Generator.
3.	To understand the Working principles of DC Motor.
4.	To understand the Working principles of Induction and synchronous machines.
5.	To understand the Working principles of Transformer.

UNIT - I	MAGNETIC CIRCUITS AND MAGNETIC MATERIALS	9

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 (Qualitative Only).

UNIT - II	DC GENERATORS	9

Construction and components of DC Machine – Principle of operation - Lap and wave windings- EMF equations– circuit model – armature reaction –methods of excitation commutation – inter poles compensating winding –characteristics of DC generators (Qualitative Only).

UNIT - III	DC MOTORS	9

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 testing and efficiency – Permanent Magnet DC (PMDC) motors-applications of DC Motor (Qualitative Only).

UNIT - IV	INDUCTION AND SYNCHRONOUS MACHINES	9

Single phase motor - Double revolving field theory - starting methods - no load and block rotor test - equivalent circuit - types of single phase motor - 3 Phase induction motor – Construction – types - principle of operation - speed control of 3 phase motor - starting methods for 3 phase induction motor. Synchronous Machine Alternator, Construction and Basic principle - Synchronous motor - Basic principle, methods of starting, applications (Qualitative Only).

BoS Chairman

UNIT - V	TRANSFORMERS	9
Transformers - Construction and types - Operation of single phase transformers - EMF equation - Voltage regulation - Losses and Efficiency - All day efficiency - Parallel operation Testing: Open circuit and Short circuit tests - 3 Phase transformers: (Construction & connections) - Autotransformers (Qualitative Only).		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the magnetic-circuits and materials.
CO2	Explain the construction and operation of DC Generator.
CO3	Explain the construction and operation of DC Motor.
CO4	Explain the construction and operation of induction and Synchronous machines.
CO5	Explain the construction, working principle of transformer and Autotransformer.

Text Books	
1.	Nagrath, I.J. and Kothari D.P., "Electrical Machines", Tata McGraw Hill Publishing Company Ltd., 4th Edition, 3rd Reprint, New Delhi, 2011.
2.	P.C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons; 3rd Edition 2013.

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

BoS Chairman

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.

BoS Chairman

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 coordinatesystems
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, OxfordUniversity Press, Sixth impression, 2010.

BoS Chairman

B.E.	B19AGP501 – POST HARVEST ENGINEERING LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	Determine various engineering properties of grains.
2.	Test and evaluate different post harvestingmachineries.
3.	Learn about efficiency of bucket elevator and screwconveyor.
4.	Learn about efficiency of rubber roll sheller
5.	To visit different rice mill industries

List of Experiments	
Expt. No.	**Description of the Experiments**
1.	Determination of moisture content of grains by oven method and moisturemeter.
2.	Determination of porosity ofgrains.
3.	Determination of coefficient of friction and angle of repose ofgrains.
4.	Testing of paddy thresher & paddywinnower.
5.	Testing of groundnut decorticator & maizesheller
6.	Evaluation of thin layerdrier
7.	Evaluation of L.S.U.drier.
8.	Determining the efficiency of bucket elevator and screwconveyor
9.	Evaluation of shelling efficiency of rubber rollsheller
10.	Determining the oil content of oilseeds.
11.	Visit to modern ricemill
12.	Visit to pulse millingindustry
	Total Instructional hours : 60

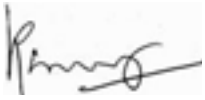
BoS Chairman

Course Outcomes	
CO1	The students will apply the knowledge in the engineering properties of grains.
CO2	The students will utilize the evaluation of different post harvestingmachineries.
CO3	The students will analyze about groundnut decorticator and drier.
CO4	Students can able to distinguish efficiency of bucket elevator and screw conveyor.
CO5	Students will take part in the visiting the industries and learn about the techniques used in milling industry.

Text Books	
1.	Chakraverty, A. Post harvest technology for Cereals, Pulses and Oilseeds. Oxford & IBH Publication Pvt Ltd, New Delhi, Third Edition, 2000.
2.	Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi, 1994.

List of Equipment Required

Sl. No.	Description of Equipment	Quantity Required
1.	Hot air oven, Grain moisturemeter	1
2.	Porosity apparatus	1
3.	Coefficient of friction apparatus	1
4.	Angle of repose – round type and L type	1
5.	Paddy thresher	1
6.	Groundnut decorticator and maize sheller	1
7.	Thin layer dryer	1
8.	LSU dryer	1
9.	Bucket elevator and screw conveyor	1
10.	Rubber roll sheller	1
11.	Oil expeller	1



BoS Chairman

B.E.	B19AGP502 – OPERATION & MAINTENANCE OF FARM MACHINERY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	The students will be introduced to the practice of different farm machinery in the field on tillage, sowing, plant protection, harvesting and threshing.
2.	To practice of care and maintenance; lubrication; fits and tolerances and replacements; adjustments of farm machines.
3.	To practice of dismantling and reassembling of a disc harrow, seed-cum fertilizer drill and sprayer, engine pumps.
4.	To know about different Hitching points
5.	To create knowledge on bulldozer operations and visit agro-manufacture industries

List of Experiments	
Expt. No.	**Description of the Experiments**
1.	Identification of major systems of a tractor and general guidelines on preliminary check measures before starting a tractor - procedure for starting, running and stopping thetractor.
2.	Identification of components of power tiller, their maintenance and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the powertiller.
3.	Field operation and adjustments ofploughs
4.	Field operation and adjustments ofharrows
5.	Field operation and adjustments ofcultivators
6.	Field operation of sowing and planting equipment and theiradjustments
7.	Field operation of plant protection equipment

8.	Field operation on mowers andreapers
9.	Field operation of combine and determination of fieldlosses
10.	Field operation of threshers and their performanceevaluation
11.	Studies on methods of repair, maintenance and off-season storage of farmequipment
12.	Opening and reassembly of disc harrows, determination and adjustment of tilt and discangles
13.	Hitching of agricultural implements andtrailers
14.	Study and operation ofbulldozer
15.	Visit toagro-manufacturers
	Total Instructional hours : 60

Course Outcomes : The students will be able to gain	
CO1	Students will able to apply knowledge on various components of tractors.
CO2	They experiment with different ploughs, harrows, cultivators.
CO3	They able to utilize the plant protection equipment.
CO4	Students will dissect on opening and resembling of disc harrow.
CO5	They will able to identify the functions of agricultural farm implements and machines.

Text Books	
1.	Jain, S.C. and C.R. Rai. Farm Tractor Maintenance and Repair. Standard publishers and Distributors, New Delhi,1999.
2.	Herbert L.Nichols Sr., Moving the Earth, D. Van Nostrand company Inc. Princeton,1959.

List of Equipment Required		
Sl. No.	**Description of Equipment**	**Quantity Required**
1.	Tractor	1
2.	Power tiller	1
3.	Disc plough	1
4.	Disc harrow	1
5.	Multi tyne cultivator	1
6.	Paddy Transplanter	1
7.	Seed drill	1
8.	Sprayer	1
9.	Mower	1
10.	Weeder	1
11.	Combine harvester (optional) – can be had as demonstration	1

BoS Chairman

B.E.	B19AGP503 – MINI PROJECT	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
2.	To train the students in preparing mini project reports, publications and initiation of patents

Students in a group of 3 or 4 shall work on a topic approved by the Head of the Department under the guidance of a faculty member and prepare a comprehensive mini project report after completing the work to the satisfaction of the supervisor. The progress of the mini project is evaluated based on three reviews by the review committee constituted by the Head of the Department. The project work is evaluated based on oral presentation and the mini project report jointly by a team of examiners including one external examiner

Total Instructional Hours: 60

Course Outcomes : Students will be able to	
❍	On completion of the mini project work, students will be in a position to take up any challenging practical problem in Agriculture and find solution by to formulating proper methodology for major project.

BoS Chairman

B.E. / B.Tech	B19CEP501 – CAREER ABILITY COURSE - II	T	P	TU	C
		0	2	0	1

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

B.E.	B19CEP504 – RURAL AGRICULTURAL ENGINEERING WORK EXPERIENCE	T	P	TU	C
		-	-	-	1

Course Objectives	
1.	To create an opportunity to the students to understand the rural setting in relation to agriculture and allied activities.
2.	To remember socio-economic conditions of the farmers and their problems..with reference to agricultural development.
3.	To create remedial knowledge to the students relevant to real field situations through practical training.
4.	To develop communication skills in students using extension teachingmethods in transfer of technology.
5.	To develop confidence and competence to solve agricultural problems.

Programme under on-station training	
Agronomy	
1.	Input use efficiency, crop productivity trends.
2.	Crop diversification possibilities
3.	On-farm water management, watershed management
4.	Integrated farming system, precision agriculture, conservation Agriculture.
5.	Meteorological status of Village (Different monsoon seasons)
Soil Science	
1.	Natural resource management
2.	Diagnosis and management of problem soils
3.	Problems & Prospects of Organic farming.
4.	Identification of major and minor element deficiency symptoms in field crops/ horticultural crops.
5.	Soil & water quality, residue management.
6.	SSNM & Nutrient Expert.
7.	Soil Fertility mapping.

BoS Chairman

Agricultural Engineering	
1.	Farm machinery and equipments.
2.	Setting up and maintenance of irrigation systems and farm ponds.
3.	On - farm water management.
4.	Watershed management.
5.	Irrigation Capitoria
6.	Poly - house construction and maintenance etc.
7.	Post - harvest processing & storage techniques.
8.	Laser - levelling.
Agricultural Economics	
1.	Socio- economic survey
2.	Co – operative and marketing
3.	Agricultural Insurance
4.	IPR, WTO & its implications
Agricultural Extension	
1.	Organization and functioning of the Directorate of Extension Education.
2.	Organization of State Department of Agriculture, Cental & State sponsored schemes.
3.	Innovations in Technology Dissemination.
4.	Extension Reforms
5.	Organizing extension activities / programmes

Break up of workload		
1.	Registration and Orientation	2 days
2.	Training on agro-ecosystem diagnostic analysis, conduct of PRA exercise On-campus training, Visit to local institutions of State / ICAR	3 days
3.	Visit and stay at villages around Zonal Research Station / KVK / NGO / Agro-industries / Progressive farmers	10 days

BoS Chairman

Monitoring & Co-ordination
A teacher from the Department of Agricultural Engineering will be designated as the coordinator to facilitate the teachers and students during rural placements. The coordinator in liaison with KVK / ZRS / NGO and other developmental departments will arrange logistics for the teachers from other departments to organize the follow up visits .of teachers to villages after the return of the. Students to ensure continued technical support to farmers.
Work diary
Evaluation of work diary indicating brief description of activities carried. out by the student every day during the placements.
Practical record / Project report
For each subject, the student will maintain a practical record. The record will have detailed description for all the topics specified under each subject: The description will be on statement of tasks carried out, sequential steps / procedure followed in completion of the task, approaches used to accomplish the task, impact of the task on the intended audience, feedback obtained, and lessons learnt. For the courses where placements in other institutions/industries are made,.each student will write a project report. The project report will have description on background of the institution, objectives, vision and mission, organizational structure, staff position; major services / goodsproduced / delivered area of operation / coverage, tasks carried out by the students, output achieved, experience gained and overall impact on the student .
Total duration : 15 days

Course Outcomes	
CO1	Students will make use of present status & scope of improvement in rural area.
CO2	They are able to choose the major interventions to bring about economic security to farmers.
CO3	The students will be able todiscover the Innovative skills.
CO4	Students willtake part in new Technologies / ideas.
CO5	They are able to support the study on natural resources.

BoS Chairman

Semester - VI

B.E. / B.TECH	B19AGT601 – ENGINEERING MATERIALS, CONSTRUCTION, ESTIMATION AND COSTING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the characteristics of stones and bricks for construction
2.	To learn various types of cementing materials lime and cement and timber for construction
3.	To understand the concept and design of foundation, stone and brick masonry
4.	To learn the engineering properties of concrete, steel and other building materials
5.	To rememberprinciples of construction, estimation and costing

UNIT - I	STONES AND BRICKS	9

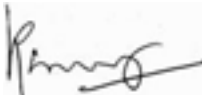
Classification of rocks – Characteristics of Stones – Testing of Stones – Manufacture of Bricks – Moulding – Drying and Burning of bricks – Properties of good Brick – Classification of Bricks – Clay Products – Ceramics – Tiles – Earthenware and Stoneware and uses.

UNIT - II	LIME, CEMENT AND TIMBER	9

Lime – Natural Sources – Types of lime – Calcination – Cement – Raw Materials – Water Cement Ratio – Manufacture of Portland Cement Wet and Dry Process – Standard Specifications – Storage of Cement – Timber – Definition – Defects in timber – Qualities of good timber – Market forms – Industrial timber – Plywood – Veneer – Thermacole – Panels of laminates.

UNIT - III	BRICK AND STONE MASONRY	9

Concept of Foundation – Factors affecting Selection of Foundations – Types of soils – Subsurface investigations – Bearing Capacity of soil – Testing & Improving Bearing Capacity of soil – Types of Foundations – Piles – Foundation in Black Cotton soil – Site Selection - Design of Foundation – General Principles – precautions in brick masonry – Stone Masonry – Comparison between Brick and Stone Masonry – Classification – General Principles and Precautions in Stone Masonry – Specification.



BoS Chairman

UNIT - IV	CONCRETE, STEEL AND OTHER MATERIALS AND PRINCIPLES OF CONSTRUCTION	9

Concrete – Ingredients – Manufacturing Process – Properties of fresh concrete – Slump – Flow and Compaction Factor – Properties of hardened concrete – Tests – Mix specification – Mix proportioning – BIS Method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete – Steel – Aluminum and Other Metallic Materials – Composition – Aluminum composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens - Basic Principles of Construction of Stones, Bricks Masonry, Concrete and RCC Structures – Introduction on preparation of estimates – Detail and Abstract estimates.

UNIT - V	ESTIMATION AND COSTING	9

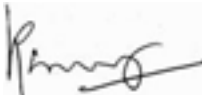
Estimation and Costing – Bill of quantities - Preparation of detail and abstract estimates for farmsteads – Bunding and Terracing – Farm roads – Check dams – Masonry weirs - Percolation ponds.

Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understanding the properties of building stones and bricks.
CO2	Outline the binding and setting properties of various types of cements and timber quality.
CO3	Able to illustrate the design foundations and construct stone and brick masonary.
CO4	Demonstrate the engineering behavioral pattern of concrete, steel and other building materials.
CO5	Apply the principles of construction and preparation of bill of cost for construction works.

Text Books

1. Deodhar, S.V and Singhal, 2001. Civil engineering materials. Khanna Publishers, 2B, Nath market, Naisark, Delhi – 6.
2. Varghese .P.C, “Building Materials”, PHI Learning Pvt. Ltd, New Delhi, 2012.
3. Rangwala .S.C., 1991. Estimating and Costing. Charotar book stall, station road, Anand.



BoS Chairman

Reference Books	
1.	Deodhar, S.V and Singhal, 2001. Civil engineering materials. Khanna Publishers, 2B, Nath market, Naisark, Delhi – 6.
2.	Handoo. B.L. and Mahajan. V.M., 1995. Civil Engineering Materials. Sathyaprakasam, 16/7698, New Market, New Rohtak road, New Delhi – 5.
3.	Datta. B.N. 2002. Estimation and Costing. Published by the Author, Tagore Palli, Motiilal Bose road, Luknow – 1.
4.	Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment andMethods", McGraw Hill, Singapore, 2006.
5.	Sharma S.C. "Construction Equipment and Management", Khanna Publishers, New Delhi,1988.
6.	https://nptel.ac.in/courses/105/102/105102088/

BoS Chairman

B.E.	B19AGT602 – IRRIGATION AND DRAINAGE ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand water resources availability and concept of irrigation with reference to crops.
2.	To learn various methods of irrigation and its hydraulics
3.	To know the various types and design of water storage and diversion structures
4.	To analyse the concept of canal irrigation and field water measurements.
5.	To learn necessity and principles agricultural drainage.

UNIT - I	WATER RESOURCES AND IRRIGATION REQUIREMENT	9

Water Resources - River basins - Development and Utilization in India and Tamil Nadu - Irrigation – Duty and Delta - Rooting characteristics - Moisture use of crop, Evapotranspiration – PET & ET Crop - Crop water requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies.

UNIT - II	METHODS OF IRRIGATION	9

Methods of Irrigation - Surface and Subsurface methods - Borders, Furrow, Check basins and Sub irrigation - Drip and Sprinkler - Hydraulics and design - Erodible and non-erodible channels - Materials for lining water courses and field channel, Water control and diversion structure - Underground pipeline irrigation system

UNIT - III	DIVERSION AND IMPOUNDING STRUCTURES	9

Head works - Weirs and Barrage - Types of impounding structures - Factors affecting, location of dams - Forces on a dam - Design of Gravity dams - Earth dams, Arch dams - Spillways - Energy dissipaters.

UNIT - IV	CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT	9

Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. Specific energy and critical depth - momentum in open channel flow – specific force – critical flow – computation. Flow measurement in channels – notches – rectangular, Cipolletti and triangular – float method - Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume – OFD works – Participatory Irrigation Management (PIM) – Evaluation Indicators.

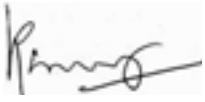
BoS Chairman

UNIT - V	AGRICULTURAL DRAINAGE	9
Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy“ s law – infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Understanding the computation of crop water requirement and to analyse water resources regime
CO2	Demonstrating the field irrigation methods and structures
CO3	Applying design skills of diversion and impounding structures
CO4	Solve the canal irrigation system and flow measurement in channels
CO5	Analyzing the drainage requirements for various crops under different field conditions

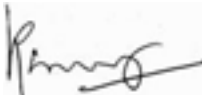
Text Books	
1.	Dilip Kumar Majumdar, “Irrigation Water Management”, Prentice - Hall of India, New Delhi
2.	Michael, A.M., “Irrigation Engineering”, Vikas Publishers, New Delhi, 2008.
3.	Garg, S.K., “Irrigation Engineering,” Laxmi Publications, New Delhi, 2008.
4.	Ritzema, H.P., “Drainage Principles and Applications”, Publication No.16, International Institute of Land Reclamation and Improvement, Netherlands, 1994.

Reference Books	
1.	Basak, N.N., “Irrigation Engineering”, Tata McGraw-Hill Publishing Co, New Delhi, 2008.
2.	Murthy, V.V.N. Land and water management, Kalyani Publishing, New Delhi, 1998.



BoS Chairman

3.	Bhattacharya, A.K., and Michael, A.M., “Land Drainage – Principles, Methods and Applications”, Konark Publishers Pvt. Ltd., New Delhi, 2003.
4.	Irrigation water Management, Training Manual No.6, Drainage of Irrigated Lands, Foods and Agriculture Organisation, Rome 1996
5.	Kessler, J., “Drainage Principles and Applications”, Vol. II and IV, International Institute of Land Reclamation and Improvement, Netherlands, 1979.
6.	Michael A.M., "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 2009.
7.	Sharma R.K and Sharma T.K., "Irrigation Engineering", S.Chand, New Delhi, 2008.
8.	https://nptel.ac.in/courses/126/105/126105010/



BoS Chairman

B.E.	B19AGT603 – DESIGN OF BASIC MACHINE ELEMENTS	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To understand the basic stresses in machine elements.
2.	To know the design of transmission systems.
3.	To understand the design aspects of shafts and couplings.
4.	To learn about the energy storing machine elements.
5.	To develop design skills of gears and bearings.

UNIT - I	STRESSES IN MACHINE MEMBERS	9

Introduction to design process - factor influencing the machine design, selection of material based on mechanical properties - Direct, bending and torsional stress equations - calculation of Principal stresses for combined loading. Design of curved beams - factor of safety - theories of failure-stress concentration - design of variable loading - Soderberg and Goodman relations.

UNIT - II	DESIGN OF POWER TRANSMISSION SYSTEMS	9

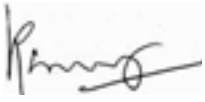
Selection of V-Belts and pulleys - selection of flat belts and pulleys - wire ropes and pulleys - selection of transmission chains and sprockets - Design of pulleys and sprockets – Hydraulic systems.

UNIT - III	DESIGN OF SHAFTS, COUPLINGS AND SPRINGS	9

Design of solid and hollow shafts based on strength and rigidity - Design of keys, keyways and splines - Design of rigid and flexible couplings. Design of bolts and nuts - knuckle and cotter joints – Design of Springs – Compression and Tension.

UNIT - IV	DESIGN OF ENERGY STORING ELEMENTS	9

Design of helical, leaf, disc and torsional springs under constant loads and varying loads - Concentric torsion springs.



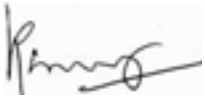
BoS Chairman

UNIT - V	DESIGN OF GEARS AND BEARINGS	9
Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation - Failure of gear teeth - Applications of different types of Gears – Crown and Pinion - Types of bearings - sliding contact and rolling contact types - Bearing selection based on application - Lubrication in journal bearings - calculation of bearing dimensions.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Able to understand various stresses in machine elements.
CO2	Demonstrating the knowledge on design of transmission systems
CO3	Illustrating the skill on design of shafts and couplings
CO4	Make use of energy storage in machine elements
CO5	Applying the design knowledge for gears and bearings.

Text Books	
1.	Khurmi R.S and Gupta J.K, A Textbook of Machine Design, Euarsia publication house, 2005.
2.	Bhandari V.B, “Design of Machine Elements”, Tata McGraw-Hill Book Co, 2003.

Reference Books	
1.	Norton R.L, Machine Design - An Integrated Approach, Pearson Publications, 3rd Edition, 2006.
2.	Ashby M.F., Materials selection in Mechanical Design 2nd Edition, Butter worth 1999.
3.	Thomas H. Courtney, Mechanical Behavior of Materials, (2nd edition), McGraw Hill, 2000
4.	Srivastava A.K., Goering.C.E. and Rohrbach R.P. Engineering Principles of Agricultural Machines. Revised Printing by American Society of Agricultural Engineers. 1993.
5.	Gary Krutz, Lester Thompson and Paul Clear., “Design of Agricultural Machinery”, John Wiley and Sons, New York, 1984.
6.	https://nptel.ac.in/courses/112/105/112105125/



BoS Chairman

Professional Elective - II

B.E.	B19AGE601 – FOOD AND DAIRY ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To create knowledge on properties and processing of milk.
2.	To learn various types of dairy products.
3.	To understand the various properties of food and their kinetics.
4.	To remember various food processing and preservation techniques.
5.	To know different food packaging materials and quality control.

UNIT - I	PROPERTIES AND PROCESSING OF MILK	9

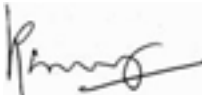
Dairy Industry – importance and status – Milk Types – Composition and properties of milk Production of high quality milk - Method of raw milk procurement and preservation – Processing - Staining - Filtering and Clarification - cream separation – Pasteurization – Homogenization sterilization, UHT processing and aseptic packaging – emulsification - Fortification.

UNIT - II	DAIRY PRODUCTS	9

Manufacture of Milk Powder - Processing of Milk Products - Condensed Milk - Skim milk - Butter milk - Flavoured Milk, whey, casein, yoghurt and paneer - Manufacture of Butter - Cheese Ghee, ice creams and frozen desserts - standards for milk and milk products - Packaging of Milk and Milk Products - Cleaning and Sanitation - Dairy effluent treatment and disposal.

UNIT - III	FOOD AND ITS PROPERTIES, REACTION AND KINETICS	9

Constituents of food - thermal processing of foods - cooking, blanching, sterilization, pasteurization, canning - Interaction of heat energy on food components, reaction kinetics, Arrhenius equation, TDT curves - water activity, sorption behaviour of foods - isotherm models - monolayer value, BET isotherms, Raoult“ s law, Norrish, Ross, Salwin - Slawson equations.



BoS Chairman

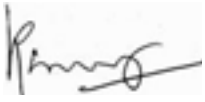
UNIT - IV	PROCESSING AND PRESERVATION OF FOODS	9
Coffee, Tea processing - Concentration of foods, freeze concentration - osmotic and reverse osmotic concentration - drying and dehydration of food - Tray, tunnel, belt, vacuum and freeze dryers - rehydration of dehydrated foods - Fat and oil processing, sources, extraction, methods and equipment, refining of oils, hydrogenation, manufacture of margarine - Food preservation methods - preservation by irradiation, microwave and dielectric heating of food.		

UNIT - V	PACKAGING AND QUALITY CONTROL	9
Food packaging, importance, flexible pouches - retort pouches - aseptic packaging, granules, powder and liquid packaging machines - nanotechnology - principles - applications in food processing - food plant location - Quality control of processed food products - Factors affecting quality.		
Total Instructional hours : 45		

Course Outcomes	
CO1	Ability to understand the process of milk scientifically for various uses.
CO2	Outline for preparing various dairy products.
CO3	Compare the properties and reactions with various food processing operations.
CO4	Understanding the skill on various drying techniques and food preservation.
CO5	Applying quality control and food processing techniques.

Text Books	
1.	Singh, R. Paul and Heldman, R. Dennis 2004, Introduction to Food Engineering, 3rd Edition, Academic Press, London.
2.	Kessler, H.G.1981 Food engineering and dairy technology, Verlag A. Kessler, Freising.

Reference Books	
1.	Walstra, P.T.J. Geurts, A. Nooman, A. Jellema and M.A. J.S Van Boekel, 2005, Dairy Technology, Marcel Dekker Inc. New york.



BoS Chairman

2.	Clunie Harvey, W.M and Harry Hill. 2009 Milk Products. IV Edition Biotech Books, New Delhi.
3.	Robinson, R.K. 1986. Modern dairy technology Vol. I Advances in Milk processing, Elsevier Applied Science Publishes, London.
4.	Charm, S.E.1971, The fundamentals of Food engineering, AVI pub, Co., Inc,
5.	Karel Marcus, Fennama, R. Owen and Lund, B.Dayal, 1975. Principles of food science, Part II - Physical principles of food preservation, Marcel Dakker, Inc.
6.	Hall, C.W and T.J. Hedrick, 1971, Drying of milk and milk products. AVI Publishing Co., West Port, Connecticut.
7.	Chandra, G.R. “Essential of Food Process Engineering”, BS Publications, 2006.
8.	Kapoor, A. “Diary Science and Technology”, Vishvabharti Publications, 2005
9.	https://nptel.ac.in/courses/126/105/126105013/

BoS Chairman

B.E.	B19AGE602 – AGRICULTURAL BUSINESS MANAGEMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To plan, organize and understand the concepts of agricultural business.
2.	To understand organizational activities of Agricultural business.
3.	To learn about various types of Agricultural marketing
4.	To analyse role of financial institution and suitability for agro business activities.
5.	To create knowledge on market promotion and handling of human resources in business

UNIT - I	CONCEPTS OF AGRICULTURAL BUSINESS	9

Agri-business - scope, characteristics, types. Management - importance, definition, management and administration, management thoughts, Small business - characteristics and stages of growth - Management functions - planning, organizing, leading.

UNIT - II	AGRI – BUSINESS ORGANIZATION	9

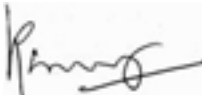
Principles, forms of agri-business organizations, staffing, directing, supervision and motivation. Controlling - types, performance evaluation and control techniques. Management approaches - Profit Centered Approach, Management by objectives and Quality Circles, Strength, Weakness, Opportunities and Threat (SWOT) Analysis.

UNIT - III	AGRICULTURAL MARKETING	9

Functional areas of Agri-business - Production and Operations management - functions, planning physical facilities and managing quality. Agro-inputs and products inventory management - raw material procurement, inventory types, and costs. Marketing management - Marketing environment, marketing mix - Agricultural input marketing firms.

UNIT - IV	AGRICULTURAL BUSINESS FINANCE	9

Forms of agri-business organizations - Role of lead bank in agribusiness finance - Financial management. Acquiring capital - Budget analysis. Concepts and determinants - Business project scheduling of raw material procurement - production management - launching products (branding, placement) - Input marketing promotion activities.



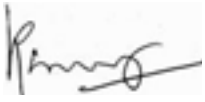
BoS Chairman

UNIT - V	MARKET PROMOTION AND HUMAN RESOURCES	9
Agricultural products - marketing promotion activities - product pricing methods. District Industries Centre - Consumer survey - Agricultural inputs retailing - Market potential assessment - types of distribution channels - Return on Investment - Personnel management. Recruitment, selection and training - Technology in Agri Business.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Understanding the fundamentals of agricultural business
CO2	Demonstrate various approaches and organizational structure in Agri business
CO3	Infer skills on Agricultural Marketing
CO4	Understanding the financial aspects and analyse budget requirement for various activities
CO5	Ability to apply market promotion activities in agri business

Text Books	
1.	Himanshu, “Agri Business Management – Problems and prospects”, Ritu Publications, Jaipur, 2005.
2.	Smita Diwase, “Indian Agriculture and Agribusiness Management”, Krishi resource Management Network, Pune 2004.

Reference Books	
1.	Chandra Prasanna, “Projects: Preparation, Appraisal, Budgeting and Implementation”, Tata McGraw Hill Publications, New Delhi, 2001.
2.	Kotler, P., “Marketing Management. Analysis, Planning and Control”, Prentice Hall Inc., New York, 2001.
3.	Rao, V.S.P., and Narayana, P.S., “Principles and Practices of Management”, Konark Publishing Private Limited, New Delhi, 2001.
4.	Tripathy, P.C., and Reddy, P.N., “Principles of Management”, Tata McGraw Hill Publications, New Delhi, 2000.
5.	Croxton, F. E., D.J. Cowden and Ben, W. Bolch. Practical Business Statistics. Prentice Hall of India Pvt. Ltd. Publication, 2008.
6.	Mamoria, C.B. and R.L. Joshi. Principles and Practice of Marketing in India. Kitab Mahal, 15, Thorn hill Road, Allahabad.
7.	https://nptel.ac.in/courses/110/107/110107145/



BoS Chairman

B.E.	B19AGE603 – AGRICULTURAL ECONOMICS AND FARM MANAGEMENT	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To understand the principles of Farm management.
2.	To learn the laws of economics.
3.	To know the cost curves and estimation of cost of cultivation.
4.	To analyse the risks and uncertainities in agricultural production process and resources management.
5.	To acquire knowledge on farm budgeting and financial analysis.

UNIT - I	FARM MANAGEMENT	9

Agricultural Economics – definition and scope – Farm Management – definition – scope – Classification of farms – Basic concepts in farm management – Relationship between farm management and other basic sciences – Farm layout – Farm records and accounts – Farm appraisal techniques – Valuation.

UNIT - II	LAWS OF ECONOMICS	9

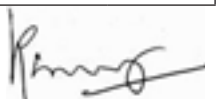
Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns – Equi-marginal returns – Product relationship – Production function – definition and types – Production function curves – Optimum level of input use – Economies of scale external and internal economies and diseconomies – Cost concepts – types – Opportunity cost – comparison of costs – Factor relationship – concepts.

UNIT - III	COST CURVES	9

Principle of substitution – isoquant, isocline, expansion path, ridge line and least cost combination of inputs – Product – product relationship – Production possibility curve, isorevenue line and optimum combination of outputs – Cost curves – Optimum input and output levels – Factor – factor relationship – Least cost combination of inputs – Estimation of cost of cultivation and cost of production of crops – annual and perennial crops – Preparation of interview schedule and farm visit for data collection.

UNIT - IV	MANAGEMENT OF RESOURCES	9

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources – land, labour, capital and measurement of their efficiencies – Mobilization of farm resources – Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques.



BoS Chairman

UNIT - V	FARM MANAGEMENT AND FINANCIAL ANALYSIS	9
Farm management- need and analysis – Farm financial analysis – Balance sheet – Income statement – Cash flow analysis – Farm investment analysis – Time comparison principles – Farm planning – Elements of farm planning – Whole farm planning and partial planning – Farm level management system – Farm budgeting – whole farm budgeting and partial budgeting – Estimation of credit – examples of farm planning and budgeting.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Understand the basic concepts and record maintenance in farm management.
CO2	Interpret the production function curves and optimum levels of input use.
CO3	Relate cost of cultivation and cost curves.
CO4	Build skill on managing farm resources.
CO5	Make use of farm planning and budgetting.

Text Books	
1.	Johl, S.S., and Kapur, T.R.,Fundamentals of Farm Business Management“, Kalyani publishers, Ludhiana, 2007.
2.	Subba Reddy, S., Raghu Ram, P., NeelakantaSastry T.V and BhavaniDevi, I., “Agricultural Economics”Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

Reference Books	
1.	Raju, V.T., “Essentials of Farm Management”, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
2.	Subba Reddy, S., and Raghu Ram, P. „ “Agricultural Finance and Management”, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
3.	Sankhayan, P.L. “"Introduction to Farm Management”, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001.
4.	Muniraj, R., “Farm Finance for Development”, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.
5.	S. Subbareddy, P. Raghu ram, Agricultural economics, oxford and IBH publishing company Pvt. Ltd. 2004.
6.	https://nptel.ac.in/courses/126/104/126104001/

BoS Chairman

B.E.	B19AGE604 – ERGONOMICS AND SAFETY IN AGRICULTURAL ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand human metabolism and energy requirements at works.
2.	To learn physical functions human physiological and operational criteria.
3.	To create knowledge on expenditure of energy on various agricultural operations.
4.	To create the knowledge in heat transfer in conduction mode.
5.	To analyse the human comfort in operator machine interface.

UNIT - I	ERGONOMICS	9

Ergonomics - introduction - Role of ergonomics in Agriculture - Human metabolism - energy liberation in human body - Types of human metaboism - energy requirements at work - acceptable work load.

UNIT - II	PHYSIOLOGICAL FUNCTIONS	9

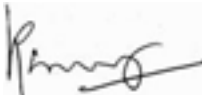
Human Skeletal system - muscle, structure and function - Physiological stress - Efficiency of work - Physical functions - Age and individual differences in physical functions - Physiological and operational criteria of physical activity.

UNIT - III	ENERGY EXPENDITURE	9

Energy expenditure of activities - keeping energy expenditure within bounds - Energy expenditure of Spraying - Weeding operations - Movements of body members - Strength and endurance of movements - Movement of body members related to Agricultural activities - Speed and accuracy of movements - Time and distance of movements - Reaction time.

UNIT - IV	ANTHROPOMETRY	9

Anthropometry - introduction - Types of data - Principles of applied anthrophometry - concept of percentile - Normal distribution - Estimating the range - Minimum and Maximum dimensions - Cost benefit analysis - applications of anthropometric data. Anthropometric consideration in tool / equipment design.



BoS Chairman

UNIT - V	HUMAN ENGINEERING IN TRACTOR DESIGN	9
The operator – Machine Interface – Operator exposure to environmental factors – Thermal comport for tractor operator – Spatial, Visual and Control requirement of the operator – Occupational health hazards - Noise – Dust - Vibration in Tractor.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Understand the human energy needs and ergonomics in agriculture.
CO2	Summarize physiological functions of human body system.
CO3	Infer knowledge on human energy expenditure for various agricultural operations.
CO4	Applying anthrophometric data in tool / equipment design.
CO5	Developing the human engineering and occupational health hazard in Tractors.

Text Books	
1.	Bridger, R.S. Introduction to ergonomics, McGraw Hill, INC, New York. 1995.
2.	Sharma, D.N. and Mukesh, S. Design of Agricultural Tractor - Principles and Problems, Jain Brothers, New Delhi. 2012.
3.	Hand Book of Agricultural Engineering, Indian Council of Agricultural Research, New Delhi. 2013. (ISBN : 978-81-7164-134-5)

Reference Books	
1.	Wesley E.Woodson, Human Factors design Hand Book, McGraw Hill Book Co., New York, 1981
2.	Dul J. and Weerdmeester B. Ergonomics for Beginners, A Quick Reference Guide, Taylor and Francis, London, 1993.
3.	https://nptel.ac.in/courses/112/104/112104222/

BoS Chairman

Professional Elective - III

B.E.	B19AGE605 – SUSTAINABLE AGRICULTURE AND FOOD SECURITY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the land resources utilization pattern with reference to agriculture.
2.	To know the water resources availability for agriculture and irrigation potential.
3.	To understand ecosystem and sustainability indicators in agriculture.
4.	To learn the demand and supply projects of food production alongwith emerging land and water markets.
5.	To create an awareness about the policies and programmes of sustainable agriculture & food security.

UNIT - I	LAND RESOURCE AND ITS SUSTAINABILITY	9

Land Resources of India, Population and land, Land utilization, Net Area Sown, changes in cropping pattern, land degradation.

UNIT - II	WATER RESOURCE AND ITS SUSTAINABILITY	9

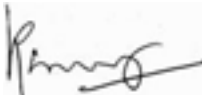
Rainfall forecasting - Adequacy of Rainfall for crop growth – Rainfall, Drought and production instability – Irrigation potential – Available, created and utilized – River basins; Watersheds and Utilizable surface water – Utilizable water in future (Ground water & Surface water) – Reuse strategies of used water.

UNIT - III	SUSTAINABLE AGRICULTURE & ORGANIC FARMING	9

Agro-ecosystems - Impact of climate change on Agriculture, Effect on crop yield, effect on Soil fertility – Food grain production at State Level – Indicators of Sustainable food availability – Indicators of food production sustenance – Natural farming principles – Sustainability in rainfed farming – organic farming – principles and practices.

UNIT - IV	FOOD PRODUCTION AND FOOD SECURITY	9

Performance of Major Food Crops over the past decades – trends in food production – Decline in total factor productivity growth – Demand and supply projections – Impact of market force – Rural Land Market – Emerging Water market – Vertical farming - Sustainable food security indicators and index – Indicator of sustainability of food Security – Path to sustainable development.



BoS Chairman

UNIT - V	POLICES AND PROGRAMMES FOR SUSTAINABLE AGRICULTURE AND FOOD SECURITY	9
Food and Crop Production polices – Agricultural credit Policy – Crop insurance – Policies of Natural Resources Use – Policies for sustainable Livelihoods – Virtual water and trade - Sustainable food Security Action Plan.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Understanding the land use for agriculture crops and cropping pattern.
CO2	Infer the knowledge on surface and groundwater availability for agriculture.
CO3	Relate various factors of sustainability in Agriculture.
CO4	Understanding the indicators of sustainable food production and security.
CO5	Choosevarious policies and progress for sustainable food security.

Text Books	
1.	B.K.Desai and Pujari, B.T. Sustainable Agriculture : A vision for future, New India Publishing Agency, New Delhi, 2007.
2.	Saroja Raman, Agricultural Sustainability - Principles, Processes and Prospects, CRC Press, 2013

Reference Books	
1.	Swarna S.Vepaetal., Atlas of the sustainability of food security. MSSRF, Chennai, 2004.
2.	Sithamparanathan, J., Rengasamy, A., Arunachalam, N. Ecosystem principles and sustainable agriculture, Scitech Publications, Chennai, 1999.
3.	Gangadhar Banerjee and Srijeet Banerji, Economics of sustainable agriculture and alternate production systems, Ane Books Pvt Ltd., 2017
4.	M.S. Swaminathan, Science and sustainable food security, World Scientific Publishing Co., Singapore, 2010.
5.	Thompson, J. & Millstone, E. Pathways to sustainable food futures in a dynamic world. Sussex University, Brighton, UK, STEPS Centre.2011.
6.	Agarwal, B. Food insecurity, productivity, and gender inequality. Institute of Economic Growth Working, Paper No. 320, University of Delhi, 2012.
7.	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ag04/

BoS Chairman

B.E.	B19AGE606 – AGRICULTURAL EXTENSION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know about communication and programme planning for extension activities
2.	To understand various extension teaching methods
3.	To create knowledge on the modern communication gadgets
4.	To analyse the concepts of Diffusion and adoption.
5.	To acquire skill on capacity building of extension personnel and farmers

UNIT - I	COMMUNICATION AND PROGRAMME PLANNING	9

Communication – meaning – definition – models – elements and their characteristics – types and barriers in communication. Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes.

UNIT - II	EXTENSION TEACHING METHODS	9

Extension teaching methods - Audio-Visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods – merits and demerits.

UNIT - III	MODERN COMMUNICATION GADGETS	9

Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone.

UNIT - IV	DIFFUSION AND ADOPTION	9

Diffusion – meaning and elements. Adoption – meaning – adopter categories and factors influencing adoption, stages of adoption, Innovation decision process and attributes of innovation consequences of adoption.

UNIT - V	CAPACITY BUILDING	9

Capacity building of extension personnel and farmers – meaning – definition, types of training, training to farmers, farm women and rural youth, FTC & KVK.

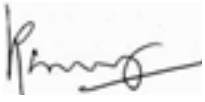
Total Instructional hours : 45

BoS Chairman

Course Outcomes	
CO1	Understanding skills on communication of programme planning
CO2	Compare different extension teaching methods
CO3	Understanding the capabilities of modern communication devices
CO4	Outline the innovation decision process and attributes for adaptation
CO5	Build a knowledge transfer to rural farmers and institutions

Text Books	
1.	Ray, G.L., 1999. Extension Communication and Management, NayaProkash, 206, BidhanSarani, Calcutta.
2.	Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. pvt. Ltd, New Delhi

Reference Books	
1.	Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, Newyork.
2.	Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
3.	Ray GL. 2006. Extension Communication and Management, Kalyani Publ.
4.	Jalihal K.A. &Veerabhadraiah V. 2007, Fundamentals of Extension Education and Management in Extension, Concept Publ. Khan
5.	https://nptel.ac.in/noc/courses/126/



BoS Chairman

B.E.	B19AGE607 – DISASTER MANAGEMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the various types of disasters.
2.	To understand the various approaches of disaster risk reduction.
3.	To analyse the various vulnerability factors and impacts of development.
4.	To understand various institutional arrangements for disaster relief, response and preparedness and damage assessment.
5.	To apply vulnerability assessment of infrastructure and to conduct case studies.

UNIT - I	INTRODUCTION TO DISASTERS	9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change - Dos and Don'ts during various types of Disasters.

UNIT - II	APPROACHES TO DISASTER RISK REDUCTION (DRR)	9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural - nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions / Urban Local Bodies (PRIs / ULBs), States, Centre, and other stake - holders - Institutional Processess and Framework at State and Central Level - State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT - III	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. - Climate Change Adaptation - IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

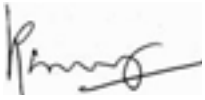
BoS Chairman

UNIT - IV	DISASTER RISK MANAGEMENT IN INDIA	9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.		

UNIT - V	DISASTER MANAGEMENT : APPLICATIONS AND CASE STUDIES AND FIELD WORKS	9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.		
Total Instructional hours : 45		

Course Outcomes	
CO1	Classify different disasters and its impacts.
CO2	Infervarious disaster risk reduction methods.
CO3	Understanding disaster vulnerability factors influencing the development.
CO4	Applying various disaster relief measures and policy suggestion including preparedness.
CO5	Solve the vulnerability assessment and results of case studies.

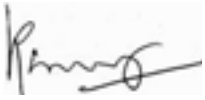
Text Books	
1.	Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2.	Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]



BoS Chairman

3.	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4.	KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

Reference Books	
1.	Sahni, Pardeep et.al. (eds.) 2002, Disaster Mitigation Experiences andReflections, Prentice Hall of India, New Delhi.
2.	Bryant Edwards 2005, Natural Hazards, Cambridge University Press,U.K
3.	Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
4.	Government of India, National Disaster Management Policy,2009.
5.	https://nptel.ac.in/courses/105/104/105104183/



BoS Chairman

B.E.	B19AGE608 – HEAT AND MASS TRANSFER FOR AGRICULTURE ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the basic concepts and equations of conduction.
2.	To understand convective heat transfer and types of convection.
3.	To learn radiation concepts and associated laws.
4.	To learn the basics of convection and radiation.
5.	To analyse mass transfer alongwith momentum and heat transfer

UNIT - I	CONDUCTION	9

Basic concepts – Mechanism of heat transfer – Conduction, convection and radiation – General differential equation of heat conduction – Fourier law of conduction – Cartesian and cylindrical coordinates – one dimensional steady state heat conduction – Conduction through plane walls, cylinders and spherical systems – Composite systems – Conduction with internal heat generation – Extended surfaces – Unsteady heat conduction – Lumped analysis – Use of Heislers chart.

UNIT - II	CONVECTION	9

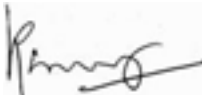
Basic concepts – Convective heat transfer coefficients – Boundary Layer concept – Types of convection – Forced convection – Dimensional analysis – External flow – Flow over plates, Cylinders and spheres – Internal flow – Laminar and turbulent flow – Combined Laminar and turbulent flow – Flow over bank of tubes – Free convection - Dimensional analysis – Flow over vertical plates, horizontal plate, inclined plate, cylinders and spheres.

UNIT - III	PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS	9

Nusselts theory of condensation – Pool boiling, flow boiling, correlations in boiling and condensation, types of heat exchangers – LMTD method of heat exchanger analysis – Overall heat transfer coefficient – Fouling Factors.

UNIT - IV	RADIATION	9

Basic concepts, law of radiation – Stefan Boltsmann law, Kirchoff law – Black body radiation – Grey body radiation shape factor algebra – Electrical analogy – Radiation shields – introduction to gas radiation.



BoS Chairman

UNIT - V	MASS TRANSFER	9
Basic concepts – Diffusion mass transfer – Fick's Law of diffusion – Steady state molecular diffusion – Convective mass transfer – Momentum, heat and mass transfer analogy – Convective mass transfer correlations.		
		Total Instructional hours : 45

Course Outcomes	
CO1	Applying conduction concepts in plane walls, cylinders and spherical structures
CO2	Identify convective transfer, coefficients wit boundary layer concepts.
CO3	Applying heat exchangers in Food industries.
CO4	Analyzing gas radiation and categorize in agriculture engineering applications.
CO5	Understand thebasic knowledge for application of diffusive and convective mass transfer in salt movement and other areas.

Text Books	
1.	Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International, New Delhi, 1995.
2.	Yadav, R., "Heat and Mass Transfer", Central Publishing House, New Delhi, 1995.

Reference Books	
1.	Ozisik, M.H., "Heat Transfer", McGraw Hill Book Co., New York, 1994.
2.	EcKert, E.R.G. Heat and Mass Transfer. McGraw Hill Book Co., New York,1981.
3.	Nag, P.K., "Heat Transfer", Tata McGraw Hill Book Co., New Delhi, 2002.
4.	Holman, J.P., Heat and Mass transfer, Tata McGraw Hill Book Co., New York, 2002.
5.	Kothandaraman, C.P., "Fundamentals of Engineering Heat and Mass Transfer", New Age International, New Delhi, 1998.
6.	Incropera, F.P., and Dewitt, D.P., "Fundamentals of Engineering Heat and Mass Transfer", John Wiley and Sons, New York, 1998.
7.	Velraj, R., "Heat & Mass Transfer", Ane Books, New Delhi, 2004.
8.	https://nptel.ac.in/courses/112/101/112101097/

BoS Chairman

Open Elective - II

B.E.	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.

BoS Chairman

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.
CO2	Illustrate the Flight Compartment Lighting Technologies and Cabin Air Conditioning system.
CO3	Identify the Warning and Protection Systems for the Ice Formation and Rain in the Airframe of the Aircraft During Flight.
CO4	Apply the Terrain Warning Systems to avoid the Terrain Collision of an Aircraft.
CO5	Examine the FDR and Fire Protection System to Monitor the Flying Performance of the Aircraft.

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.

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		

BoS Chairman

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.

BoS Chairman

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.

BoS Chairman

B.E.	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

BoS Chairman

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, 10th 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, 2nd 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.

BoS Chairman

B.E. / B.TECH	B19ECO601 – GEOGRAPHIC INFORMATION SYSTEM	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.

BoS Chairman

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.

BoS Chairman

B.E. / B.TECH	B19EEO601 - FUNDAMENTALS OF POWER ELECTRONICS (Common to all Except EEE)	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 the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
5.	To understand the operation of AC Voltage controller and Cyclo converter with various Configurations.

UNIT - I	POWER SWITCHING DEVICES	9

Study of switching devices - Diode, SCR, DIAC,TRIAC, GTO, BJT, MOSFET, IGBT - Static and Dynamic characteristics – Gate triggering circuit and commutation circuit for SCR - Introduction to Driver and snubber circuits - Heat sink calculation.

UNIT - II	AC TO DC CONVERTERS	9

Introduction - Single Phase and Three Phase controlled Rectifiers - Effect of source inductance – performance parameters - Firing Schemes for converter – Dual converters, Applications - Solar PV Systems, Light Dimmer.

UNIT - III	DC TO DC CONVERTER	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.

UNIT - IV	DC TO AC CONVERTERS	9

Single phase half bridge inverter and Full bridge inverter - Three phase voltage source inverters (both 120° mode and 180° mode) - Voltage & harmonic control - PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM - Introduction to Space Vector. Pulse Width Modulation - Current Source Inverter - Multilevel Inverter - Applications-Induction heating, UPS.

BoS Chairman

UNIT - V	AC TO AC CONVERTERS	9
Single phase and three phase AC voltage Controllers – Control strategy - Power Factor Control – Multistage sequence control - Single Phase and Three Phase Cyclo Converters – Introduction to Matrix converters, Applications: 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 the operation 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 Cyclo converter 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. / 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.

BoS Chairman

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 Developmentll S. Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.

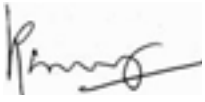
Reference Books	
1.	Hisrich R D, Peters M P, — Entrepreneurship 8th Edition, Tata McGraw-Hill, 2013.
2.	Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011.

BoS Chairman

B.E.	B19AGP601 – IRRIGATION FIELD LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To develop the practical skill in handling meteorological instruments.
2.	To understand the infiltration behavior of different soils using infiltrometer.
3.	To know the design of drip and sprinkler irrigation system.
4.	To learn about the procedures of field flow measurements.
5.	To analyse the uniformity and efficiency of micro irrigation systems.

List of Experiments	
Expt. No.	**Description of the Experiments**
1.	To study various instruments in the Meteorological Laboratory
2.	Determination of infiltration rate using double ring and digital infiltrometer
3.	Determination of soil moisture wetting pattern for irrigation scheduling
4.	Design of Drip irrigation system
5.	Design of sprinkler irrigation system
6.	Measurement of flow properties in open irrigated channels (flumes, notches)
7.	Evaluation of surface irrigation
8.	Determination of uniformity coefficient for drip irrigation system
9.	Determination of uniformity coefficient for sprinkler system (catch can method)
10.	To conduct experiment on disc filter for micro irrigation systems
11.	Visit to Automatic Weather Station
	Total Instructional hours : 60



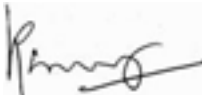
BoS Chairman

Course Outcomes : Students will be able to	
CO1	The students will be able to utilize the meteorological data for assessing crop water requirement
CO2	Experiment with the intake rate of various soils with reference to irrigation system design
CO3	Analyze theperformance on hydraulic designs of drip and sprinkler system.
CO4	Evaluate the flow measurement devices in irrigation.
CO5	Estimation of drip and sprinkler systems for uniformity of water distribution.

Text Books	
1.	Michael, A.M., “Irrigation Theory and Practice“, Vikas Publishing House, New Delhi, 1999.
2.	Asawa, G.L., “Irrigation Engineering", New Age International Private Limited, New Delhi, 1996.
3.	Laboratory Manual, Centre for Water Resources, Anna University, Chennai.

List of Equipment Required

Sl. No.	Description of the Equipment	Quantity required
1.	Meteorological lab with Cup counter anemometer, Sunshine recorder, Open pan vaporimeter, Stevenson’s screen - Dry bulb, wet bulb thermometers, recording and nonrecording type rain gauge etc	1 (Each)
2.	Double ring infiltrometer	1
3.	Digital infiltrometer	1
4.	Parshall flume, cut throat flume	1
5.	V notch, Rectangular notch and trapezoidal notch	1
6.	Drip irrigation system with all accessories	-
7.	Sprinkler irrigation system with all accessories	-
8.	Required number of stop watches	-
9.	Weighing balance	1
10.	Catch cans, measuring jars	Required Numbers



BoS Chairman

B.E.	B19AGP602 – ICT LABORATORY FOR AGRICULTURAL ENGINEERS	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To apply the ICT tools in irrigation management
2.	To understand the use of agro meteorological sensors.
3.	To create knowledge on mobile applications in agriculture.
4.	To learn crop simulation models
5.	To apply cloud services and farm advisories for technology transfer

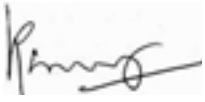
List of Experiments	
Expt. No.	**Description of the Experiments**
1.	Configuring timers for automatic switching “on and off” of irrigation systems
2.	Experience with solenoid valves for pressurized irrigation
3.	Using sensors for Agro meteorological measurements
4.	Employing Printed Circuit Board (PCB) or Breadboard for controlling or triggering an agricultural system
5.	Use of mobile apps for controlling or triggering an agricultural system
6.	Construction of crop growth function (best fit) for crop yields simulations
7.	Image Processing as tool for biotic and abiotic stress identification
8.	Experience with existing open source crop simulation models
9.	Exposing cloud resources for agricultural applications
10.	Developing automated agro advisory systems
	Total Instructional hours : 60

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Build the knowledge in ICT tools in irrigation
CO2	Applying the practical skill on use of meteorological sensors.
CO3	Discover gadgets with mobile application in agriculture.
CO4	Evaluatingthe crop response under various input constraints.
CO5	Create networking of farms and technology adoption in farms.

List of Equipment Required

Sl. No.	Description of the Equipment	Quantity required
1.	Timing devices and small pumps for simulations	Required Nos
2.	Solenoid valves and layout of drip or sprinkler system	Required Nos
3.	Time Domain Reflectometer (TDR)	-
4.	Digital thermometer	1
5.	Breadboards, relays etc.	-
6.	MATLAB software	-
7.	Open source Crop simulation models – any one for demonstration	-
8.	Other facilities for cloud resources, agro advisory systems etc.	-

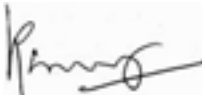


BoS Chairman

B.E.	B19AGP603 – FOOD PROCESS ENGINEERING LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To know the cooking properties and microbial load of food materials
2.	To understand properties of extruded and microwave heated foods
3.	To analyse the properties of milk and cream separator efficiency.
4.	To evaluate the protein content food items
5.	To analyse the oil absorption characteristics of snacks

List of Experiments	
Expt. No.	**Description of the Experiments**
1.	Determination of cooking properties of parboiled and raw rice.
2.	Estimation of microbial load in food materials
3.	Determination of rehydration ratio of dehydrated foods
4.	Experiment on osmotic dehydration of foods
5.	Experiment of food extruder
6.	Experiment on properties of food through microwave oven heating
7.	Determination of properties of milk
8.	Experiments on cream separator to determine the separation efficiency
9.	Experiments on construction and operation of butter churn and butter working accessories
10.	Experiments on detection of Food Adulteration
11.	Experiments on estimation of protein in food
12.	Experiment on expansion and Oil absorption characteristic of snacks on frying
The lab includes visit to food processing and dairy industry	
Total Instructional hours : 60	



BoS Chairman

Course Outcomes : Students will be able to	
CO1	Applying the cooking properties of raw, parboiled rice and other items.
CO2	Make use of the principles of dehydration foods.
CO3	Analyzing the properties of milk and separation efficiency of cream separator including butter churn.
CO4	Examine the protein content of foods.
CO5	Evaluating the expansion and oil absorption characteristics of fried foods.

Text Books	
1.	Singh, R.Paul. and Heldman, R.Dennis.2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.
2.	Kessler, H.G.1981. Food engineering and dairy technology, Verlag A. Kessler, Freising.

Reference Books	
1.	Walstra, P.T.J. Geurts, A. Nooman, A. Jellema and M.A. J.S Van Boekel. 2005. Dairy Technology. Marcel Dekker Inc. New york.
2.	Clunie Harvey, W.M and Harry Hill. 2009 Milk Products. IV Edition Biotech Books, New Delhi.
3.	Robinson, R.K.1986. Modern dairy technology Vol.I Advances in Milk processing. Elsevier Applied Science Publishes, London.
4.	Charm, S.E.1971. The fundamentals of Food engineering, AVI pub.Co.,Inc,
5.	Karel Marcus, Fennama, R. Owen and Lund, B. Dayal. 1975. Principles of food science, Part II - Physical principles of food preservation, Marcel Dakker, Inc.
6.	HaII,C.W and T.J. Hedrick. 1971. Drying of milk and milk products. AVI Publishing Co., West Port, Connecticut.
7.	https://nptel.ac.in/courses/126/105/126105013/

BoS Chairman

List of Equipment Required		
Sl. No.	**Description of the Equipment**	**Quantity required**
1.	Extruder	1
2.	Pasteurizer	1
3.	Hot air oven	1
4.	Hand refractometer	1
5.	Dessicator	1
6.	Dean and Stark‟s apparatus	1
7.	Cabinet dryer	1
8.	Soxhlet flask	1
9.	Distillation column	1
10.	Kjeldahl flask	1
11.	Distillation apparatus	1
12.	Microwave oven	1
13.	Cream separator	1
14.	Butter churner	1

BoS Chairman

B.E. / B.TECH	B19CEP601 CAREER ABILITY COURSE – III (Agricultural Finance and Banking)	T	P	TU	C
		0	2	0	–

Course Objectives	
❍	To impart the knowledge on Agricultural Finance
❍	To acquire skills on Farm financial analysis and credit proposals.
❍	To understand the role of finance institutions for Agricultural development.
❍	To understand banking and Cooperation for agricultural and agro based industries and financial issues
❍	To know the functions of various institutions involved in farm financing and 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, 3R's and 7 P'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).

BoS Chairman

UNIT - IV	CO-OPERATION	9

Co-operation: Philosophy and Principles - History of Indian Co-operative credit movement: Pre and Post - Independence periods and Co-operation in different plan periods - Co-operative credit institutions: Two tier and three tier structure, Functions: provision of short term and long term credit, Strength and weakness of co-operative credit system, Policies for revitalizing co-operative credit: Salient features of Vaithiyanathan Committee Report on revival of rural co-operative credit institutions, Reorganization of Co-operative credit structure in Andhra Pradesh and single window system and Successful co-operative credit systems in Gujarat, Maharashtra, Punjab, etc. - Special Co-operatives: 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) - 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.

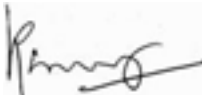
Total Instructional hours : 45

Course Outcomes	
CO1	Understand the sources of Agricultural Micro-Macro financing and credit systems.
CO2	Summarize the History of financing agriculture in India
CO3	Infer about Significance and limitations of Crop insurance.
CO4	To develop Knowledge of successful cooperative systems in India and newly launched crop insurance schemes.
CO5	Make use of Credit requirement of farm business.

BoS Chairman

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. Kalyani Publishers. New Delhi.
4.	Mammoria, C.B. and R.D. Saxena. 1973. Cooperation in India. KitabMahal. Allahabad.
5.	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,
3.	Prentice-Hall of India , New Delhi, 1983
4.	https://www.nabard.org/



BoS Chairman

Semester - VII

B.E.	B19AGT701 – SOIL AND WATER CONSERVATION ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the principles of water and wind erosion.
2.	To learn the estimation methods of soil erosion.
3.	To understand the water and wind erosion control measures.
4.	To learn the various water harvesting techniques and earthen dams.
5.	To rememberthe sedimentation transport process, estimation and control measures.

UNIT - I	SOIL EROSION PRINCIPLES	9

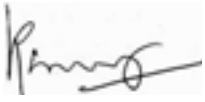
Approaches to soil conservation – Soil conservation in India - Erosion – Agents - Causes - Mechanics of water erosion – Soil erosion problems - Types of water erosion: Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion, Stream bank erosion – Classification of Gully –- Landslides – Shifting cultivation - Wind Erosion – Principles and Mechanics - Land use capability classification - Classification of eroded soils.

UNIT - II	ESTIMATION OF SOIL EROSION	9

Runoff computation for soil conservation: SCS-CN method – Evolution of Universal Soil Loss Equation: Applications and Limitations – Modified Universal Soil Loss Equation – Revised Universal Soil Loss Equation - Permissible erosion – Estimation of Wind Erosion.

UNIT - III	EROSION CONTROL MEASURES	9

Prerequisites - Agronomic practices: contour cultivation - strip cropping – tillage practices – Soil management practices – Bunding: Types and design specifications - Mechanical measures for hill slopes – Terracing: Classification and design specification of bench terrace – Grassed waterways: Location, construction and maintenance – Types of temporary and permanent gully control structures - Gully Control Structures: Drop Spillway, Drop Inlet, Chute Spillways – Wind Erosion control measures – Wind break and Shelter belts – Sand dunes Stabilization.



BoS Chairman

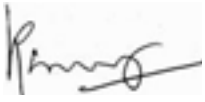
UNIT - IV	WATER CONSERVATION MEASURES	9
In-situ soil moisture conservation – Water harvesting principles and techniques: Micro catchments, catchment yield using morphometric analysis - Farm ponds: Components, Design, Construction and Protection – Check dams - Earthen dam – Retaining wall.		

UNIT - V	SEDIMENTATION	9
Sediment: Sources – Types of sediment load – Mechanics of sediment transport – Estimation of bed and suspended load – Sediment Graph - Reservoir sedimentation: Basics - Factors affecting sediment distribution pattern, Rates of reservoir sedimentation - Silt Detention Tanks – Sediment control methods.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Understand the concepts and principles of soil erosion.
CO2	Solve the water and wind erosion estimation methods.
CO3	Able to design various soil erosion control measures.
CO4	Analyze the in-situ and ex-situ water harvesting methods.
CO5	Evaluate the factors and distribution of sedimentation of water resources and control measures.

Text Books	
1.	Suresh, R., “Soil and Water Conservation Engineering”, Standard Publication, New Delhi, 2007.
2.	Ghanshyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.
3.	“Sedimentation Engineering”, 2006, ASCE Manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing.

Reference Books	
1.	Murthy, V.V.N., “Land and Water Management Engineering”, Kalyani Publishers, Ludhiana, 1998.
2.	Gurmail Singh, “A Manual on Soil and Water Conservation”, ICAR Publication, New Delhi, 1982.
3.	Mal, B.C., “Introduction to Soil and Water Conservation Engineering”, Kalyani Publishers, New Delhi, 2002.
4.	https://nptel.ac.in/courses/126/105/126105012/



BoS Chairman

B.E.	B19AGT702 – SOLAR, WIND AND BIO ENERGY ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the solar energy availability and applications.
2.	To know the solar photovoltaic technology and design.
3.	To understand wind energy potential, corrosion devices and design of wind mills.
4.	To learn the characterization of biomass and biogas production methods.
5.	To gain knowledge on ethanol production and gasification process.

UNIT - I	SOLAR ENERGY RADIATION, THERMAL COLLECTORS AND CONCENTRATORS	9

Solar radiation availability - radiation measurement – transmittance - absorptance – Basic earth sun angles - estimation of average solar radiation, radiation on tilted surface - Flat plate collectors - heat transfer correlations - collector efficiency - heat balance – absorber plate – types - selective surfaces. Solar water heaters - types- performance. Solar dryers – types – agro industrial applications - Concentrating collectors – types – reflectors - solar thermal power stations – principle and applications - Solar energy storage systems - Solar distillation – application - Solar stills - types - Solar pond.

UNIT - II	SOLAR PV TECHNOLOGY	9

Solar photovoltaic technology – introduction – solar cell basics – Types of solar cells and modules – encapsulation – Design of solar PV system – load estimation - batteries – invertors – operation - system controls. Standalone and grid connected systems - PV powered water pumping - Hybrid system - Solar technologies in green buildings.

UNIT - III	WIND ENERGY AND WIND MILLS	9

Nature of the wind – power in the wind – factors influencing wind – wind energy potential and installation in India- wind speed monitoring - wind resource assessment -wind power laws - velocity and power duration curves - Betz limit - site selection - Wind energy conversion devices - classification, characteristics, applications – Design of horizontal axis wind mill rotor diameter - Wind energy storage - wind farms - wheeling and banking - testing and certification procedures. Water pumping - Hybrid systems.

BoS Chairman

UNIT - IV	BIOMASS CHARACTERIZATION AND BIO-GAS PRODUCTION	9
Biomass types and characteristics - biomass conversion technology - steps in biogas production - parameters affecting gas production - Types of biogas plants - Construction details - operation and maintenance - Biogas appliances - Bio reactors / fermentors – Batch type – continuous stirred tank reactors - Biological waste water treatment- Activated sludge process - Downstream processing.		

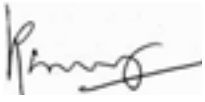
UNIT - V	ETHANOL PRODUCTION AND GASIFICATION	9
Ethanol production - Acid hydrolysis - enzyme hydrolysis - Methanol synthesis - Antibiotics - enzymes - principles of thermochemical conversion – combustion - pyrolysis - Gasification – types of gasifiers - Improved wood burning stove - Energy plantations - Biomass briquetting - Cogeneration		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand solar energy availability and design of various solar devices.
CO2	Infer the knowledge on Solar PV Technology and pumps.
CO3	Illustrate thethe assessment of wind energy and wind mill types
CO4	Develop knowledge on Bio-mass characterization and bio-gas production
CO5	Utilize the Ethanol production and gasification systems.

Text Books	
1.	Rai., G.D. “Solar Energy Utilization” Khanna publishers, New Delhi, 2002.
2.	More, H.S and R.C. Maheshwari, “ Wind Energy Utilization in India” CIAE Publication – Bhopal, 1982.
3.	Solanki, C.S. “Renewable Energy Technologies: A Practical guide for beginners”, PHI learning Pvt. Ltd, New Delhi. 2008.
4.	Rai G.D, Non conventional sources of Energy, Khanna publishers, New Delhi, 1995.
5.	Bouley James .E & David Follis - Biochemical Engineering Fundamentals McGraw-Hill publishing company, Tokyo.1986

BoS Chairman

Reference Books	
1.	Solanki, C.S. “Solar Photovoltaic Technology and Systems”, PHI learning Pvt. Ltd., New Delhi, 2013.
2.	Rao. S and B.B. Parulekar. “Energy Technology – Non conventional, Renewable and Conventional”, Khanna Publishers, Delhi, 2000.
3.	Rajput. R.K. “Non- Conventional Energy Sources and Utilization”, S. Chand & Company Pvt. Ltd, New Delhi, 2013.
4.	Chawla O.P, Advances in Biogas Technology ICAR publication New Delhi 1986 Ashby M.F., Materials selection in Mechanical Design 2nd Edition, Butter worth 1999.
5.	https://onlinecourses.nptel.ac.in/noc21_ch11/preview



BoS Chairman

Professional Elective - IV

B.E.	B19AGE701 – PROCESS ENGINEERING OF FRUITS VEGETABLES	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To create knowledge about internal composition of horticultural crops and different ripening methods.
2.	To learn the cleaning and grading of fruits and vegetables.
3.	To understand the preservation of fruits and vegetables related technologies.
4.	To know different dryers with working principles and their construction.
5.	To apply different storage conditions for fruits and vegetables.

UNIT - I	STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE	9

Importance of post harvest technology of horticultural crops – post harvest losses – factors causing losses - structure, cellular components, composition and nutritive value of horticultural crops – fruit ripening – maturity indices - mechanism and equipment - spoilage of perishable commodities – mechanism and factors causing spoilage.

UNIT - II	CLEANING, GRADING AND ON-FARM PROCESSING	9

Harvesting and washing of fruits and vegetables – cleaning and grading – fruits and vegetables - peeling - equipments – construction and working – pre-cooling – importance, methods, pretreatments and advantages.

UNIT - III	PRESERVATION OF FRUITS AND VEGETABLES	9

Thermal and non-thermal techniques of preservation of fruits and vegetables and their products - methods - minimal processing of horticultural commodities – fruits and vegetables, advantages - quick freezing preservation - commercial canning of fruits, vegetables and other perishable commodities – processing and concentration of juice - membrane separation process and application - hurdle technology of preservation and techniques.

UNIT - IV	DRYING AND DEHYDRATION	9

Dehydration of fruits and vegetables – types of dryers, construction and working - methods – fluidized bed dryer, freeze drying, osmotic dehydration and foam mat drying – principles, construction, operation and applications - quality parameters and advantages.

BoS Chairman

UNIT - V	STORAGE	9
Storage of fruits and vegetables – storage under ambient conditions, low temperature storage, evaporative cooling – cold storage of horticultural commodities – estimation of cooling load - controlled atmosphere storage – concept and methods – modified atmosphere packaging – gas composition, quality of storage – waxing of fruits – types of wax, equipment and advantages.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand composition and ripening parameters of fruits.
CO2	Infer the grading and post harvest of fruits and vegetables.
CO3	Classify the preservation techniques for different fruits and vegetables.
CO4	Outline the working and construction of different dryers with its applications.
CO5	Apply skills about different storage and waxing of fruits.

Text Books	
1.	Fellows. P. 2000. Food Processing Technology – Principles and Practice, second edition, CRC Press, Woodland Publishing Limited, Cambridge, England.
2.	Sudheer K. P. and V. Indra.2007. Post harvest Technology of Horticultural Crops. New India Publishing Company, New Delhi.
3.	L.R. Verma and V.K. Joshi, 2000. Post Harvest Technology of Fruits and Vegetables – Handling, Processing, Fermentation and Waste management. Indus Publishing, company, New Delhi.

Reference Books	
1.	Heid,J.L. and M.A.Joslyn. 1983. Food processing operations. Vol. II. AVI Publishing Co. Inc. Westport, Connecticut.
2.	Potter, N.N.1976. Food science. AVI Publishing Co. Inc.Westport, Connecticut, 2nd edition.

BoS Chairman

3.	Sivetz Michael and N.W. Desrosier. 1979. Coffee Technology. AVI Publishing Co. Inc, Westport, Connecticut.
4.	Frank .H. Slade. 1967. Food Processing Plant. Volume 1. Leonard Hill Books. London.
5.	SudhirGupta.Cold storage unit. Atif printers, LalKuan, Delhi.
6.	NIIR board. Modern techniques on food preservation. Asia pacific business press inc. Delhi
7.	Humbertovega and Gustavo v Barbosa. 1996. Dehydration of foods. Springer Science, Business Media, Chapman & Hall Publishers, U.K.
8.	https://nptel.ac.in/courses/126/105/126105011/

BoS Chairman

B.E.	B19AGE702 – CLIMATE CHANGE AND ADAPTATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the earth's climate system.
2.	To understand the atmosphere and its compounds.
3.	To learn about the impacts of climate change on Agriculture, Forestry, Water Resources and other Ecosystems.
4.	To analyse the observed changes and their causes.
5.	To create knowledge on clean development mechanism and mitigation measures.

UNIT - I	EARTH'S CLIMATE SYSTEM	9

Role of ozone in environment - Ozone layer - ozone depleting gases - Green House Effect, Radiative effects of Greenhouse Gases - Hydrological Cycle - Green House Gases and Global Warming – Carbon Cycle.

UNIT - II	ATMOSPHERE AND ITS COMPONENTS	9

Importance of Atmosphere – Physical, Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability - Temperature profile of the atmosphere - Lapse rates - Temperature inversion - effects of inversion on pollution dispersion.

UNIT - III	IMPACTS OF CLIMATE CHANGE	9

Causes of Climate change : Change of Temperature in the environment - Melting of ice Pole - sea level rise - Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT - IV	OBSERVED CHANGES AND ITS CAUSES	9

Climate change and Carbon credits - CDM - Initiatives in India - Kyoto Protocol Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – Global Scale and in India.

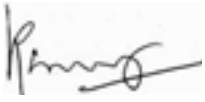
BoS Chairman

UNIT - V	CLIMATE CHANGE AND MITIGATION MEASURES	9
Clean Development Mechanism – Carbon Trading - examples of future Clean Technology – Biodiesel – Natural Compost – Eco friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding - Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) – Waste - MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the Greenhouse effect and Global warming concepts.
CO2	Classify the components of atmosphere.
CO3	Apply skills on impact studies on climate change.
CO4	Organize the observed changes, IPCC and UNFCC.
CO5	Choosemitigation measures and adaptation to climate change.

Text Books	
1.	Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007.

Reference Books	
1.	Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
2.	Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3.	Jan C. van Dam, Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003.
4.	https://onlinecourses.nptel.ac.in/noc21_ge16/preview



BoS Chairman

B.E.	B19AGE703 – INTELLECTUAL PROPERTY RIGHTS AND ETHICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the genesis and development of IPR.
2.	To learn the registration procedures, trade secrets in India and abroad.
3.	To know the various international, traditional agreements and legislations.
4.	To analyse the digital innovation and developments.
5.	To acquire knowledge on enforcement of IPRS.

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 IPR	9

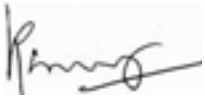
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT - III	AGREEMENTS AND LEGISLATIONS	9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT - IV	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 IPR Laws – Case Studies.



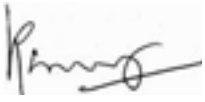
BoS Chairman

UNIT - V	VENFORCEMENT OF IPR	9
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the basic ideas of genesis and development of IPR.
CO2	Demonstrate the registration processes and trade secrets.
CO3	Inferthe knowledge onagreements and legislations of IPR.
CO4	Outline skill on digital products and legal issues.
CO5	Construct emerging issues in enforcement of IPRS.

Text Books	
1.	V. ScopleVinod, 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.	Prabuddha Ganguli, “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.	https://nptel.ac.in/courses/110/105/110105139/



BoS Chairman

B.E.	B19AGE704 – REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand basic principles and components of Remote sensing.
2.	To learn the various data products and satellite image processing concepts.
3.	To know the cartography principles and components of GIS.
4.	To remember different spatial and non-spatial database models.
5.	To know the applications of remote sensing and GIS in agriculture.

UNIT - I	CONCEPTS OF REMOTE SENSING AND SATELLITES	9

Definition - Historical background - Components of remote sensing – Energy source, electromagnetic spectrum, radiation principle, platforms and sensors - Active and passive remote sensing interference - Atmospheric effects on remote sensing – Energy interaction with earth surface feature - Data acquisition - Reflectance, spectral signatures for water, soil and vegetation - Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT, SPOT & IRS - Resolution - Spectral, spatial, radiometric and Temporal resolution - Recent satellites with its applications.

UNIT - II	DATA PRODUCTS AND IMAGE ANALYSIS	9

Data products – based on level of processing - scale – area/coverage – data availability – data ordering - data price - Image interpretation – Visual interpretation elements – interpretation key - Digital image processing – Image enhancement – image classification – Supervised and unsupervised – Vegetation Indices.

UNIT - III	CONCEPTS OF GIS	9

Definition – Map and their influences – Characteristics of Maps – Elements – Map scale, Projection, Coordinate systems – Sources of spatial data – History and development of GIS – Definition – Components – Hardware and Software.

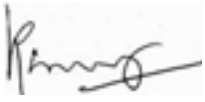
BoS Chairman

UNIT - IV	DATA INPUT AND ANALYSIS	9
Data – Spatial, Non-Spatial – Database models – Hierarchical network, Relational and Object Oriented Data Models – Raster and Vector – Methods of Data input – Data Editing – Files and formats – Data structure – Data compression. Introduction to analysis – Measurements – Queries – Reclassification – Simple spatial analysis – Buffering – Neighboring functions – Map overlay – Vector and raster – Spatial interpolation – Modelling in GIS – Digital Elevation Modelling – Expert systems.		

UNIT - V	APPLICATION OF RS AND GIS	9
Crop Acreage estimation - Estimation of Crop Water Requirement – Crop condition - Soil mapping – classification of soil with digital numbers – soil erosion mapping - reservoir sedimentation using image processing - Inventory of water resources – UAV Applications in Resources mapping - Application of Remote Sensing and GIS in Precision Agriculture - Monitor Crop Health - Management Decision Support Systems.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the basic concepts of Remote Sensing.
CO2	Relate the data products and concepts of Digital Image Processing.
CO3	Demonstrate knowledge in Cartography and components of GIS.
CO4	Apply the GIS database models in various proceses.
CO5	Make use of the skills on applications of Remote sensing and GIS in agriculture.

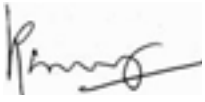
Text Books	
1.	Anji Reddy. M, Remote Sensing and Geographical Information Systems, BS Publications, Hyderbad, 2001
2.	Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2000.



BoS Chairman

3.	Jensen, J.R. Introductory Digital Image Processing – A Remotesensing Prerspective,Fourth Edition, Pearson, 2016.
4.	Garg, P.K. Theory and Principles of Geoinformatics, Khanna Book Publishing Co. Delhi, 2019.

Reference Books	
1.	Chandra, A.M. and Ghosh, S.K., “Remote Sensing and Geographical Information Systems”, Alpha Science,2005.
2.	Bossler, J.D., “Manual of Geospatial Science and Technology”, Taylor and Francis, 2002..
3.	Bettinger, P., and Michael, G.W., “Geographical Information System: Applications in Forestry and Natural Resources Management,” Tata McGraw–Hill Higher Education, New Delhi, 2003
4.	Ian Heywood., “An Introduction to GIS”, Pearson Education, New Delhi, 2001.
5.	Jeffery Star and John Estes, “Geographical Information System – An Introduction,” Prentice Hall India Pvt. Ltd., New Delhi, 1998.
6.	Patel A.N &Surendra Singh, “Remote sensing principles & applications”, Scientific Publishers, Jodhpur 1992.
7.	https://www.iirs.gov.in/EDUSAT-News
8.	https://nptel.ac.in/courses/105/108/105108077/



BoS Chairman

Professional Elective - V

B.E.	B19AGE705 – STORAGE AND PACKAGING TECHNOLOGY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand damages of perishables and losses in storage.
2.	To know various storage methods and structures.
3.	To understand the function of packaging materials.
4.	To learn the testing methods of food packaging materials.
5.	To create knowledge on special packaging techniques.

UNIT - I	SPOILAGE AND STORAGE	9

Direct damages, Indirect damages of perishable and durable commodities – Control measures - factors affecting storage – types of storage – Losses in storage and estimation of losses.

UNIT - II	STORAGE METHODS	9

Improved storage methods for grain - Modern storage structures - infestation - temperature and moisture changes in storage structures - CAP storage - CA storage of grains and perishables - Construction, operation and maintenance of CA storage facilities.

UNIT - III	FUNCTIONS OF PACKAGING MATERIALS	9

Introduction – Packaging strategies for various environment – Functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.

UNIT - IV	FOOD PACKAGING MATERIALS AND TESTING	9

Introduction – paper and paper boards - flexible - plastics - glass containers – cans – aluminium foils - package material testing-tensile, bursting and tear strength.

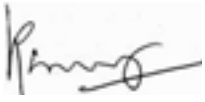
BoS Chairman

UNIT - V	SPECIAL PACKAGING TECHNIQUES	9
Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand storage losses of perishables.
CO2	Infer knowledge on storage principles and structures.
CO3	Select various functions of packaging materials.
CO4	Construct the quality of food packaging material
CO5	Make use of special packaging techniques like vaccum, tetra and antimicrobial etc.

Text Books	
1.	Sahay, K.M. and K.K. Singh, 1996. Unit operations of agricultural processing, Vikas Publishing House Pvt. Ltd., New Delhi.
2.	Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.
3.	Pandey, P.H.2002. Post harvest engineering of horticultural crops through objectives. Saroj Prakasam. Allahabad.

Reference Books	
1.	Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.
2.	Chakaraverty, A. 2000. 3rd edition, Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co. Pvt. Ltd. New Delhi.
3.	https://onlinecourses.nptel.ac.in/noc20_ag02/preview



BoS Chairman

B.E.	B19AGE706 – PROTECTED CULTIVATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know about various types of protected cultivation.
2.	To understand the protected cultivation technology of vegetable crops.
3.	To create knowledge on hi-tech protected cultivation of flower crops.
4.	To understand the precision farming techniques and tools used.
5.	To acquire skill on the precision farming of horticultural crops.

UNIT - I	PROTECTED CULTIVATION AND ITS TYPES	9

Importance and methods of protected culture in horticultural crops - Importance and scope of protected cultivation – different growing structures of protected culture viz., green house, poly house, net house, poly tunnels, screen house, protected nursery house - study of environmental factors influencing green house production – cladding / glazing / covering material – ventilation systems – cultivation systems including nutrient film technique / hydroponics / aeroponic culture – growing media and nutrients – canopy management – micro irrigation and fertigation systems.

UNIT - II	PROTECTED CULTIVATION OF VEGETABLE CROPS	9

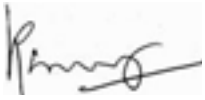
Protected cultivation technology for vegetable crops - Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons – integrated pest and disease management – post harvest handling.

UNIT - III	PROTECTED CULTIVATION OF FLOWER CROPS	9

Protected cultivation technology for flower crops - Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliages and fillers – integrated pest and disease management – postharvest handling.

UNIT - IV	PRECISION FARMING TECHNIQUES	9

Concept and introduction of precision farming – Importance, definition, principles and concepts – Role of GIS and GPS - Mobile mapping system and its application in precision farming – design, layout and installation of drip and fertigation – georeferencing and photometric correction – Sensors for information gathering – UAV - geostatistics – robotics in horticulture – postharvest process management (PPM) – Remote sensing.



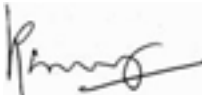
BoS Chairman

UNIT - V	PRECISION FARMING OF HORTICULTURAL CROPS	9
Precision farming techniques for horticultural crops - Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand knowledge on Protected cultivation.
CO2	Apply protected cultivation techniques for vegetable crops.
CO3	Select Hi-tech protected cultivation methods for flower crops.
CO4	Make use of the various precision tools for farming.
CO5	Categorize the precision farming techniques of Horticultural crops.

Text Books	
1.	Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.
2.	Paul V. Nelson. 1991. Green house operation and management. Ball publishing USA.

Reference Books	
1.	Lyn. Malone, Anita M. Palmer, Christine L. Vloghat Jach Dangeermond. 2002. Mapping out world: GIS lessons for Education. ESRI press.
2.	David Reed. 1996. Water, Media and nutrition for green house crops. Ball publishing USA.
3.	Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors, Darya ganj, New Delhi.
4.	https://nptel.ac.in/courses/126/105/126105014/



BoS Chairman

B.E.	B19AGE707 – REFRIGERATION AND AIR CONDITIONING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the principles and concepts of Air refrigeration system.
2.	To understand the various types of compressors and quality of refrigerants.
3.	To analyse thepsychrometric principles and use of psychrometric charts.
4.	To understand the various Air conditioning systems and cooling load calculations.
5.	To apply the unconventional refrigeration cycles.

UNIT - I	REFRIGERATION CYCLE	9

Review of thermodynamic principles of refrigeration. Concept of Air refrigeration system. Vapour compression refrigeration cycle – use of p-h charts – multistage and multiple evaporator systems – cascade system – COP comparison.

UNIT - II	REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING	9

Compressors – Scroll Compressors - reciprocating & rotary (elementary treatment) – condensers – evaporators cooling towers. Refrigerants – Properties – selection of refrigerants, Alternative refrigerants, cycle controls.

UNIT - III	PSYCHROMETRY	9

Psychrometric processes use of psychrometric charts – grand and room sensible heat factors – bypass factors – air washers, requirements of comfort air conditioning, summer and winter air conditioning.

UNIT - IV	AIR CONDITIONING SYSTEMS	9

Cooling load calculation - working principles – centralized air conditioning systems, split, ductable split, packaged air conditioning, VAV & VRV systems. Duct design by equal friction method, indoor air quality concepts.

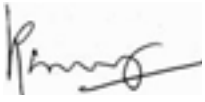
BoS Chairman

UNIT - V	UNCONVENTIONAL REFRIGERATION CYCLES	9
Vapor absorption systems – Ejector jet, steam jet refrigeration, thermo electric refrigeration. Applications: ice – plant – food storage plants – milk chilling plants.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the principles of Air refrigeration system.
CO2	Summarize various compressors, condensers, evaporators and refrigerants.
CO3	Outline Psychrometry principles.
CO4	Apply Air conditioning systems and their design methods.
CO5	Construct the unconventional refrigeration cycles in food storage plants.

Text Books	
1.	Manohar Prasad, “Refrigeration and Air Conditioning”, Wiley Eastern Ltd., New Delhi, 1983.
2.	Arora, C.P., “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 1988.

Reference Books	
1.	Dossat, R.J., “Principles of Refrigeration and Air Conditioning”, Pearson Education Pvt. Ltd., New Delhi, 1997.
2.	Jordon and Priester, “Refrigeration and Air Conditioning”, Prentice Hall of India Pvt. Ltd., New Delhi, 1985.
3.	Stoecker, N.F., and Jones, “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 1981.
4.	https://nptel.ac.in/courses/112/105/112105129/



BoS Chairman

B.E.	B19AGE708 – ON FARM WATER MANAGEMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the design concepts of irrigation channels and field water control structures.
2.	To understand command area and irrigation water distribution system.
3.	To learn conjunctive use of surface and groundwater.
4.	To know the concepts of water balance, performance indicators and efficiencies.
5.	To analyse water policy issues, irrigation conflicts and water pricing

UNIT - I	DESIGN OF IRRIGATION CHANNELS AND WATER CONTROL STRUCTURES	9

Design of Erodible and Non-Erodible, Alluvial channels - Kennedy's and Lacey's Theories - Materials for lining watercourses and field channel - Water control and Diversion structure - Design - Land grading - Land leveling methods.

UNIT - II	COMMAND AREA	9

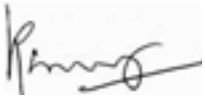
Command area - Concept – CADA Programmes - Duty of water - expression - relationship between duty and delta - Warabandhi - water distribution and Rotational Irrigation System – case studies.

UNIT - III	CONJUNCTIVE USE OF SURFACE AND GROUNDWATER	9

Availability of water - Rainfall, canal supply and groundwater – Irrigation demand - water requirement and utilization - Prediction of over and under utilization of water – Dependable rainfall – Rainfall analysis by Markov chain method – Probability matrix.

UNIT - IV	WATER BALANCE	9

Groundwater balance model – Weekly water balance - Performance indicators – Adequacy, Dependability, Equity and efficiency – conjunctive use plan by optimization – Agricultural productivity indicators – Water use efficiency.



BoS Chairman

UNIT - V	SPECIAL TOPICS	9
National water policy - Institutional aspects - Socio-economic perspective - Water users Associations - Seepage loss in command area - Irrigation conflicts - Water productivity – Water pricing.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply the design criteria to farm level water conveyance and distribution structures.
CO2	Construct the command area water distribution system.
CO3	Plan the conjunctive use of surface and groundwater method.
CO4	Make use of water balance, equity and efficiency of irrigation water use.
CO5	Examine knowledge on institutional, socio-economic and water policy issues.

Text Books	
1.	Michael, A.M. Irrigation Theory and practice, Vikas publishing house, New Delhi, 2006.

Reference Books	
1.	Keller, J. and Bliesner D. Ron, 2001 Sprinkler and Trickle irrigation, Anari book, Published by Van No strand Rein hold New York.
2.	Israelson, 2002, Irrigation principles and practices, John Wiley & sons, New York.
3.	Modi, P.N., 2002. Irrigation and water resources and water power engineering, Standard Book House, New Delhi.
4.	Michael, A.M. and Ojha, T.P. 2002. Principles of Agricultural Engineering Vol.II Jain Brothers, New Delhi.
5.	Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
6.	https://nptel.ac.in/courses/105/102/105102159/

BoS Chairman

Open Elective - III

B.E. / B.TECH	B19AEO701 - UNMANNED AIRCRAFT SYSTEMS OPERATION & 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.

BoS Chairman

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

BoS Chairman

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/).

BoS Chairman

B.E.	B19BMO701 - TELEMEDICINE	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.

BoS Chairman

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.

BoS Chairman

B.TECH.	B19BTO701 - FUNDAMENTALS OF NANOTECHNOLOGY	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.

BoS Chairman

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.

BoS Chairman

B.E.	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.

BoS Chairman

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 ll, 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.

BoS Chairman

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.

BoS Chairman

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", 2nd Eidtion, pearson education, india, 2009.
2.	B.P. Lathi, "Modern Digital and Analog Communication systems", 4th 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.

BoS Chairman

B.E. / B.TECH	B19EEO701 – HYBRID ELECTRIC VEHICLE (Common to all Except EEE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To present a comprehensive overview of Electric and Hybrid Electric Vehicles.
2.	To understand the concept of hybrid electric vehicles and its operations.
3.	To impart knowledge on applications of drives in hybrid electric vehicles.
4.	To impart knowledge on vehicular communication in hybrid electric vehicles.
5.	To provide knowledge about various possible energy storage technologies that can be used in hybrid electric vehicles.

UNIT - I	INTRODUCTION TO HYBRID ELECTRIC VEHICLES	9

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basics of vehicle performance, vehicle power source characterization, transmission characteristics and mathematical models to describe vehicle performance.

UNIT - II	HYBRID ELECTRIC DRIVE - TRAIN	9

Basic concept of electric traction, Transmission configuration - Components - Gears - Differential - Clutch – Brakes, Regenerative braking, motor sizing. Hybrid traction: Various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel Efficiency Analysis.

UNIT - III	ELECTRIC COMPONENTS IN HYBRID AND ELECTRIC VEHICLES	9

Electric Drives in HEV/EVs, Classification and Characteristics, configuration and Control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives and Switched Reluctance Motor drives for HEV/EVs applications, Drive System efficiency.

UNIT - IV	SIZING THE DRIVE SYSTEM	9

Performance matching of Electric Machine and the Internal Combustion Engine (ICE), Sizing the propulsion motor, Communications, supporting subsystems, sizing the power electronic devices and Energy Storage Technology.

BoS Chairman

UNIT - V	ENERGY MANAGEMENT STRATEGIES	9
Introduction to energy management strategies used in hybrid and electric vehicle, classification – implementation issues. Battery based energy storage: fuel cell based and super capacitor based energy storage and its analysis. Hybridization of different energy storage devices. Case study: Volvo XC90 T8 Plug-In Hybrid, Nissan X-Trial hybrid		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Infer the hybrid electric vehicles and its impact on environment.
CO2	Outline the working of hybrid electric drive train.
CO3	Interpret the electric components used in hybrid and electric vehicles.
CO4	Illustrate the various communication protocols and technologies used in vehicle. networks
CO5	Explain the different energy storage systems for vehicle applications.

Text Books	
1.	M. Ehsani, Y. Gao, S. Gay and Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2015.
2.	Iqbal Hussain, “Electric & Hybrid Vechicles – Design Fundamentals”, Second Edition, CRC Press, 2011.
3.	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2009.

Reference Books	
1.	Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
2.	Chris Mi, MA Masrur, and D W Gao, "Hybrid Electric Vehicles- Principles and Applications with Practical Perspectives", Wiley, 2011.
3.	Davide Andrea, "Battery management Systems for Large Lithium-Ion Battery Packs", Artech House, 2010.
4.	Sira -Ramirez, R. Silva Ortigoza, ‘Control Design Techniques in Power Electronics Devices’, Springer, 2006.
5.	James Larminie and John Lowry, “Electric Vehicle Technology”, Wiley Publishers, 2003.

BoS Chairman

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).		

BoS Chairman

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.	CK Chua, Kah Fai Leong, “3D Printing and Rapid Prototyping - Principles and Applications”, World Scientific, 2017.

BoS Chairman

B.E.	B19AGP701 – DESIGN AND DRAWING OF FARM STRUCTURES	T	P	TU	C
		0	4	1	3

Course Objectives	
1.	To understand planning of various farm buildings for residence, livestock, storage and roads.
2.	To learn the design aspects of cattle sheep and poultry houses, silos and machinery sheds.
3.	To acquire the drawing skills of various farm structures.
4.	To analyse the farm fencing methods and designs of sanitary structures.
5.	To learn the farm roads, culverts and drawing of such structures.

List of Experiments

Expt. No.	Description of the Experiments
1.	Planning and Layout of farmstead
2.	Design and Drawing of stall bam
3.	Design and Drawing of loose housing and milk parlors
4.	Design and Drawing of poultry house
5.	Design and Drawing of a sheep / goat house
6.	Design and Drawing of ventilation system for dairy and poultry house
7.	Design and Drawing of silos – over ground and underground and hay storages
8.	Design and Drawing of farm fencing system
9.	Design and Drawing of machinery and equipment shed and workshops
10.	Design and Drawing of septic tank and sanitary structures
11.	Design and Drawing of rural/farm roads and culverts.
12.	Design and Drawing of underground irrigation pipe systems.
	Total Instructional hours : 60

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Build theplanning and lay-out various farm structures.
CO2	Organize the design procedures of Livestock, farm houses, poultry houses and storage structures.
CO3	Utilize theskill on drawing of various farm structures.
CO4	Classify the fencing methods, sanitation and related structures in the farm.
CO5	Examine the road, culvert and underground irrigation pipe distribution network.

Text Books	
1.	Barre, H.J. and Sammet, L.L. "Farm Structures". John Wiley and Sons Inc. 1950.
2.	Neubaur, L. W. and Walker, H.B. "Farm Buildings Design". Prentice Hall Inc., 1961.
3.	Khanna, S.K. and Justo, C.E.G. "Highway Engineering". Nemchand and Bros., Roorkee, India.,1990.
4.	Lennart P. Bengtsson, James H. Whataker “Farm structures in Tropical Climate”, FAO, United Nations, Rome, 1986.

Reference Books	
1.	Neubaur, L. W. and Walker, H.B. "Farm Buildings Design". Prentice Hall Inc., 1961.
2.	Dutta, B.N. "Estimating and Costing in Civil Engineering Theory and Practice". S. Dutta and Co,2020.
3.	Bazirani, V.N. and Ratwani, M.M. "Steel Structures". Khanna Publishers, Delhi, 1981.
4.	Justo, C.E.G. and Khanna, S.K. "Highway Engineering". Nemchand and Bros., Roorkee, India (Revised).
5.	https://nptel.ac.in/courses/126/105/126105010/

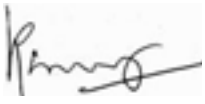
BoS Chairman

B.E.	B19AGP702 – GIS LABORATORY FOR AGRICULTURAL ENGINEERS	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To understand the basics of photogrammetry and visual image interpretation techniques.
2.	To know the various GIS and image processing software and tools.
3.	To apply the enhancement and classification methods using different satellite images.
4.	To create database management system using GIS software.
5.	To understand the various applications of DEM, Watershed, Runoff and soil erosion Modeling.

List of Experiments

Expt. No.	Description of the Experiments
1.	Measurement of relief displacement using parallax bar
2.	Stereoscopic vision test
3.	Aerial and Satellite image interpretation - visual
4.	Introduction to QGIS
5.	Geo-referencing of images
6.	Image enhancement practice
7.	Supervised and Unsupervised classification practice
8.	Database Management Systems (Vector Data Representation)
9.	Spatial data input and editing – Digitizing
10.	Raster analysis problems – Database query
11.	GIS applications in DEM and its analysis
12.	GIS application in watershed analysis/rainfall-runoff modeling
13.	GIS application in soil erosion modelling
	Total Instructional hours : 60



BoS Chairman

Course Outcomes : Students will be able to	
CO1	Apply the experiment with photogrammetric techniques
CO2	Analyze the satellite and aerial photographs using visual interpretation methods
CO3	Examine various image enhancement and classification methods
CO4	Classify the database using GIS software.
CO5	Evaluate of satellite datasets using different applications (DEM, Watershed, Runoff and Soil erosion).

Text Books	
1.	Lillesand, T.M. and Kiefer, R.W. 2005. “Remote Sensing and Image Interpretation“, II edition. John Wiley & sons.
2.	Heywood, I., Cornelius. S., Carver. S 2002. An Introduction to Geographical Information Systems, Addison Wesley Longman, New York.
3.	Bossler, J.D., 2002. “Manual of Geospatial Science and Technology”, Taylor and Francis

Reference Books	
1.	Garg, P.K., 2019.“Theory and Principles of Geoinformatics”, Khanna Book Publishing Co. Delhi
2.	Floyd F.Sabins. 2005. “Remote Sensing: Principles and Interpretation”, III edition.
3.	Freeman and Company New York.
4.	Jensen, J.R., 2004. “Introductory Digital Image Processing: A Remote Sensing Perspective”. Prentice – Hall. New Jersey.
5.	https://www.iirs.gov.in/EDUSAT-News

BoS Chairman

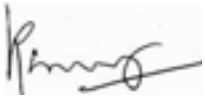
List of Equipment Required		
Sl. No.	**Description of the Equipment**	**Quantity required**
1.	Parallax Bar	10
2.	Vision Test Card – Pocket Mirror Stereoscope	10
3.	Mirror Stereoscope	10
4.	Light Table	6
5.	SOI Toposheets	10
6.	Aerial Photographs	10
7.	Satellite Images	10
8.	Computer System with accessories	35
9.	Software – Open Source (QGIS)	-

BoS Chairman

B.E.	B19AGP703 – RENEWABLE ENERGY LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To analyse the biomass for its characterization.
2.	To understand the calorific value of solids and gaseous fuels.
3.	To learn various design of bio-gas plants.
4.	To learn the testing of bio-gas/producer gas engines, gasifiers and dryers.
5.	To apply the photovoltaic technology for water pumping.

List of Experiments	
Expt. No.	**Description of the Experiments**
1.	Characterization of biomass – proximate analysis
2.	Determination of caloric value of fuels – solids and gases
3.	Design of KVIC / Deenbandhu model biogas plant
4.	Study of UASB biomethanation plant
5.	Purification of biogas – CO2 and H2S removal
6.	Performance evaluation of agro based gasifier.
7.	Study on Pyrolysis unit – Biochar, Charcoal and Tar making process
8.	Testing of biogas/producer gas engines
9.	Study on briquetting and Stoichiometric calculations
10.	Automatic weather station – Analysis of wind data and prediction
11.	Testing of solar water heater
12.	Testing of natural convection solar dryer
13.	Study on Solar power and I-V Characteristics
14.	Testing of solar photovoltaic water pumping system
	Total Instructional hours : 60



BoS Chairman

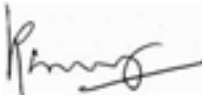
Course Outcomes : Students will be able to	
CO1	Apply the analytical capacity of biomass characterization.
CO2	Choose to determine calorific value of solid & gaseous fuels.
CO3	Categorize designing of various types of bio-gas plants.
CO4	Evaluate bio-gas/producer gas engines, gasifiers and dryers.
CO5	Assessthe photovoltaic technology application in water pumping systems.

Text Books	
1.	Solanki, C.S. “Renewable Energy Technologies: A Practical guide for beginners”. PHI learning Pvt. Ltd, New Delhi. 2008.

Reference Books	
1.	Khandelwal, K.C. and Mahdi, S.S. “Biogas Technology”. Tata McGrawHill Pub. Co. Ltd., New Delhi, 1986.
2.	Nijaguna, B. T. “Biogas Technology” New Age International Pvt. Ltd., New Delhi, 2006.
3.	Rao. S and B.B. Parulekar. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi, 2000.
4.	Solanki, C.S. “Solar Photovotaics – Fundamentals, Technologies and Applications”, PHI Learning Pvt. Ltd., New Delhi, 2011.

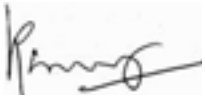
List of Equipment Required

Sl. No.	Description of the Equipment	Quantity required
1.	Hot air oven	1
2.	Muffle furnace	1
3.	Junkers gas calorimeter	1



BoS Chairman

4.	Bomb calorimeter	1
5.	Model of Biogas and Deenabandhu biogas plant	1
6.	Biogas scrubbing unit	1
7.	Gasifier	1
8.	Pyrolysis unit	1
9.	Biogas/ Producer gas dual fuel Engine	1
10.	Briquetting Machine - Lab Scale	1
11.	Automatic weather station	1
12.	Solar water heater	1
13.	Solar dryer	1
14.	Solar PV training kit	1
15.	Solar PV water pumping system	1



BoS Chairman

Semester - VIII

Professional Elective - VI

B.E.	B19AGE801 – MICRO IRRIGATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To create knowledge on water lifting devices.
2.	To learn various types of valves in pipe distribution network and irrigation.
3.	To understand micro irrigation principles and applications.
4.	To remember hydraulics of micro irrigation and design aspects.
5.	To know different sprinkler irrigation devices and fertigation systems.

UNIT - I	WATER LIFTS AND PUMPS	9

Pump classification Variable displacement pumps – Centrifugal pump - Submersible pump - Vertical Turbine pumps - mixed flow – Jet and Airlift pumps - Pump selection and installation - Pump troubles and Remedies.

UNIT - II	VALVES	9

Types of valves - Pressure relief valve - Gate valve - Isolated valve - Non return valve - Butterfly valve - Solenoid valves - Automatic control valve- selection, repair and maintenance.

UNIT - III	MICRO IRRIGATION CONCEPT AND APPLICATIONS	9

Micro irrigation - Comparison between traditional and micro irrigation method – Water requirement of crops - Merits and demerits of micro-irrigation system, Types and components of microirrigation system - Scope and potential problem of micro irrigation - Low cost Micro irrigation technologies - Gravity fed micro irrigation - Care and maintenance of microirrigation System - Economics of micro-irrigation system - Automation in micro-irrigation-Surge and cablegation irrigation - Greenhouse irrigation system – Uniformity of water distribution.

UNIT - IV	DRIP IRRIGATION DESIGN	9

Drip irrigation - Components - Dripper - types and equations governing flow through drippers - Wetting pattern - Chemigation application – Fertigation devices - Pump capacity - Installation - Operation and maintenance of Drip irrigation system - Design of surface and sub-surface drip irrigation.

BoS Chairman

UNIT - V	SPRINKLER IRRIGATION DESIGN	9
Sprinkler irrigation - Components and accessories - Hydraulic design - Sprinkler selection and spacing - Capacity of sprinkler system - types - Sprinkler performance - Sprinkler discharge - Water distribution pattern - Droplet size, filtering unit, fertigation systems maintenance.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the performance evaluation of various irrigation pumps.
CO2	Apply the use of valves in irrigation systems.
CO3	Analyze the various applications of micro irrigation systems.
CO4	Categorizethe hydraulic design of Drip irrigation systems.
CO5	Examine design parameters and analyzing water distribution in sprinkler systems.

Text Books	
1.	Suresh, R., “Principles of Micro-Irrigation Engineering”, Standard Publishers Distributors, New Delhi, 2010.
2.	Michael, A.M., “Irrigation Theory and Practice”, Vikas Publishers, New Delhi, 2002.

Reference Books	
1.	Modi, P.N., and Seth, S.M., “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi, 1991.
2.	Jack Keller and RondBelisher., “Sprinkler and Trickle Irrigation”, Vannistr and Reinhold, New York, 1990.
3.	Sivanappan R.K., “Sprinkler Irrigation”, Oxford and IBH Publishing Co., New Delhi, 1987.
4.	Keller. J and D. Karmeli, “Trickle Irrigation Design”, Rainbird Sprinkler Irrigation Manufacturing Corporation, Glendora, California, USA.
5.	Centrally Sponsored Scheme on “Micro Irrigation Drip & Sprinkler Irrigation Guidelines”, Ministry of Agriculture, Department of Agriculture & Cooperation, Krishi Bhawan, New Delhi – 110001, 2006.
6.	https://nptel.ac.in/courses/126/105/126105019/

BoS Chairman

B.E.	B19AGE802 – WATERSHED MANAGEMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To plan, understand and organizewatershed development and Management.
2.	To understand prioritization of watersheds and developmental plans.
3.	To learn about participatory watershed management and structural measures.
4.	To analyse several water conservation practices suited to irrigated and dry areas.
5.	To create knowledge on the goals and agencies of watershed development programmes.

UNIT - I	INTRODUCTION	9

Watershed – Definition – Delineation - concept - Objectives – Land capability classification - priority watersheds - land and water resource regions in India.

UNIT - II	WATERSHED PLANNING	9

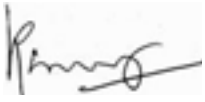
Planning principles – collection of data – present land use – PRA exercise - Preparation of watershed development plan - Estimation of costs and benefits - Financial plan – selection of implementation agency - Monitoring and evaluation system.

UNIT - III	WATERSHED MANAGEMENT	9

Participatory watershed Management - run off management - Factors affecting runoff - Temporary & Permanent gully control measures - Water conservation practices in irrigated lands - Soil and moisture conservation practices in dry lands.

UNIT - IV	WATER CONSERVATION PRACTICES	9

In-situ & Ex-situ moisture conservation principle and practices - Afforestation principle - Micro catchment water harvesting - Ground water recharge – Percolation ponds -Water harvesting - Farm pond - Supplemental irrigation - Evaporation suppression - Seepage reduction.



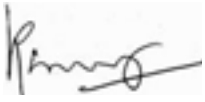
BoS Chairman

UNIT - V	WATERSHED DEVELOPMENT PROGRAMME	9
River Valley Project (RVP) - Hill Area Development Programme (HADP) - National Watershed Development Programme for Rainfed Agriculture (NWDPRA) – DPAP - Other similar projects operated in India – Govt. of India guidelines on watershed development programme - Watershed based rural development – Institutional and social issues - Use of Aerial photography, Remote sensing and GIS in watershed management - Role of NGOs in watershed development.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the Watershed development.
CO2	Illustrate the various prioritization issues and watershed development plans.
CO3	Demonstrate the skills on participatory watershed management and structural measures.
CO4	Outline the water conservation practices for irrigated and dry tracts.
CO5	Build the goals and activities under various Watershed Development Programmes.

Text Books	
1.	Ghanashyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.
2.	Tideman, E.M., “Watershed Management”, Omega Scientific Publishers, New Delhi, 1996.

Reference Books	
1.	Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
2.	Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
3.	Tripathi R.P. and H.P.Singh 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi
4.	Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.
5.	https://nptel.ac.in/courses/105/101/105101010/



BoS Chairman

B.E.	B19AGE803 – TILLAGE MECHANICS AND TRACTION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the mechanics of tillage tools and engineering properties of soil.
2.	To learn the force analysis and design of tillage tools.
3.	To know the traction principles traction model and prediction.
4.	To understand the type of tyres, lug geometry and testing and cage wheels.
5.	To acquire the knowledge on soil dynamics in relation to plant growth.

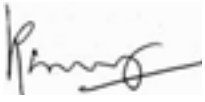
UNIT - I	MECHANICS OF TILLAGE	9
Introduction - mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship		

UNIT - II	DYNAMICS OF TILLAGE	9
Design of tillage tools - Hydraulicmould board - Reversible plough - principles of soil cutting, design equation, force analysis, application of dimensional analysis in soil dynamics, performance of tillage tools.		

UNIT - III	TRACTION	9
Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction.		

UNIT - IV	TYRES AND CAGE WHEELS	9
Tyre size, tyre lug geometry and their effects, tyre testing.		

UNIT - V	APPLICATIONS	9
Soil compaction and plant growth, variability and geo statistics, application of GIS in soil dynamics.		
		Total Instructional hours : 45

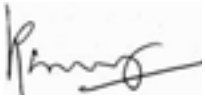


BoS Chairman

Course Outcomes : Students will be able to	
CO1	Understand the basic mechanics of tillage tools and engineering properties of soil.
CO2	Outline the force analysis and design of tillage tools.
CO3	Understand the knowledge on traction theory and model.
CO4	Classify types of tyres and tyre testing, cage wheels.
CO5	Apply the soil dynamics behavior and its influence on plant growth.

Text Books	
1.	Klenin, N.L.; Popov, I.F. and V.A. Sakum, (1985). Agricultural machines. Amerind Pub. Co. New York.
2.	J. B. Liljedahl, P. K. Turnquist, D. W. Smith, & M. Hoki , 1996. Tractors and their power units. Fourth ed. American Society of Agricultural Engineers, ASAE.
3.	Kepner, R. A., Roy Bainer and E. L. Barger. 1978. Principles of farm machinery. Third edition; AVI Publishing Company Inc: Westport, Connecticut.

Reference Books	
1.	Ralph Alcock.1986. Tractor Implements System. AVI Publ.
2.	S.C. Jain, Farm Machinery- An Approach
3.	https://nptel.ac.in/courses/126/105/126105009/



BoS Chairman

B.E.	B19AGE804 – SPECIAL FARM EQUIPMENTS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand weeding and intercultural equipment.
2.	To learn various types of sprayers, dusters and other plant protection devices.
3.	To create knowledge on harvesters for various crops.
4.	To learn threshers, chaff cutters and mowers.
5.	To analyse specialized farm equipment for specific operations.

UNIT - I	WEEDING AND INTERCULTURAL EQUIPMENT	9

Weeding and intercultural equipment. Junior hoe - guntaka - blade harrow - rotary weeders for upland and low land - selection, constructional features and adjustments - Spading machine – coir pith applicators.

UNIT - II	SPRAYERS AND DUSTERS	9

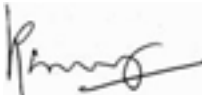
Sprayers – Sprayer operation – boom sprayer - precaution - coverage - factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) - Electrostatic sprayers - Areal spraying – Drones - Air assist sprayers - orchard sprayers - Dusters - types - mist blower cum duster - other plant protection devices, care and maintenance.

UNIT - III	HARVESTERS	9

Construction and adjustments - registration and alignment. Windrowers, reapers, reaper binders and forage harvesters. Diggers for potato, groundnut and other tubers. Sugarcane harvesters - cotton pickers - corn harvesters - fruit crop harvesters – vegetable harvesters.

UNIT - IV	THRESHERS AND OTHER MACHINERIES	9

Thresher – construction and working of multi crop thresher. Forest machinery - shrub cutters - tree cutting machines – post hole diggers – Chaff cutter- flail mowers –Mower mechanism - lawn mowers – tree pruners.



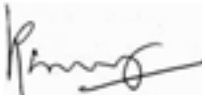
BoS Chairman

UNIT - V	FARM EQUIPMENTS FOR SPECIALIZED OPERATIONS	9
Pneumatic planters – air seeders – improved ploughs – reversible ploughs – suction traps – seed and fertilizer broadcasting devices, manure spreaders, sweep weeders – direct paddy seeders, direct paddy cum daincha seeder, coconut tree climbing devices, tractor operated hoist, tractor operated rhizome planter - Transplanters and Balers.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Illustrate the weeding and Intercultural equipments.
CO2	Understand the sprayers, dusters and plant protection devices.
CO3	Infer knowledge and harvesters of various crops.
CO4	Understand the threshers, chaff cutters, mowers and pruners.
CO5	Construct various specialized farm equipments to different operations.

Text Books	
1.	JagdishwarSahay. 2010. Elements of Agricultural Engineering. Standard Publishers Distributors, New Delhi 6.
2.	Michael and Ojha. 2005. Principles of Agricultural Engineering. Jain brothers, New Delhi.

Reference Books	
1.	Kepner, R.A., et al. 1997. Principles of farm machinery. CBS Publishers and Distributers, Delhi.
2.	Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi.
3.	Srivastava, A.C. 1990. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi
4.	https://nptel.ac.in/courses/126/105/126105009/



BoS Chairman

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.

BoS Chairman

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.	Julian Happian-Smith, “An Introduction to Modern Vehicle Design”, Butterworth- Heinemann Ltd., 2002.

Reference Books	
1.	Wolf-Heinrich Hucho (Eds.), “Aerodynamics of Road Vehicles: From Fluid Mechanics to Vehicle Engineering”, Butterworth-Heinemann Ltd., 1987.
2.	Ian R Sinclair, Sensors and Transducers, Butterworth - Heinemann Ltd., 2001.
3.	T.K. Garrett, K. Newton & W. Steeds, “the Motor Vehicle”, Butterworth- Heinemann Ltd., 2001

BoS Chairman

B.E. / B. TECH.	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.

BoS Chairman

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.E. / 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.

BoS Chairman

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 : Student 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		

BoS Chairman

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

BoS Chairman

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.

BoS Chairman

B.E./ B.TECH	B19EEO801 – ENERGY CONSERVATION AND MANAGEMENT (Common to all Except EEE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To acquire the knowledge about the current energy scenario and importance of energy conservation, audit and management.
2.	To understand about the economics associated with energy conservation..
3.	To understand about the different electrical systems and the methods of improving energy efficiency.
4.	To improve the thermal efficiency by designing suitable systems for heat recovery and co-generation.
5.	To understand how to conserve energy in Major utilities

UNIT - I	INTRODUCTION	9

Energy - Power – Past and Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers - Instruments for energy auditing - energy security - Material and energy balance diagrams.

UNIT - II	ECONOMICS	9

Energy Economics – energy pricing - Fixed and variable costs, Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing – ESCO concept.

UNIT - III	ELECTRICAL SYSTEMS	9

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT - IV	THERMAL SYSTEMS	9

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation – Steam Distribution and Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization and Insulators - Waste Heat Recovery - Cogeneration.

BoS Chairman

UNIT - V	ENERGY CONSERVATION IN MAJOR UTILITIES	9
Energy conservation in Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Interpret the basic knowledge of current energy scenario and importance of energy conservation and management.
CO2	Summarize the knowledge of economics associated with energy conservation.
CO3	Apply the methods of improving energy efficiency in different electrical systems.
CO4	Make use of the heat utilization, saving and recovery in different thermal systems.
CO5	Interpret the knowledge of energy conservation in Major utilities.

Text Books	
1.	Murphy W.R. and G. Mckay Butter worth, “Energy Management”, Heinemann Publications, 2013.
2.	Guide books for National Certification Examination for Energy Managers and Energy Auditors, Book 1, 2, 3 & 4. Bureau Energy Efficiency, a statutory body under Ministry of Power, Government of India, New Delhi. 2005.
3.	W.C.Turner, “Energy Management Handbook”, John Wiley and Sons, Fifth edition, 2013.

Reference Books	
1.	Amlan Chakrabarti, Energy Engineering and Management, Prentice hall India 2011.
2.	John.C.Andreas, “Energy Efficient Electric Motors”, Marcel Dekker Inc Ltd – 2nd edition; 2015.
3.	Paul o’ Callaghan, “Energy Management”, Mc-Graw Hill Book Company – 1st edition; 2012.
4.	Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publications, Washington, 1988.
5.	www.em-ea.org/gbook1.asp

BoS Chairman

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	9
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.		

UNIT - V	LEAN INVOLVEMENT AND CULTURE	9
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		

BoS Chairman

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.

BoS Chairman

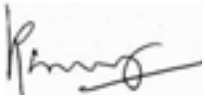
B.E.	B19AGP801 – PROJECT WORK	T	P	TU	C
		0	20	0	10

Course Objectives	
❍	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
❍	To train the students in preparing project reports, publications and initiation of patents.

Students in a group of 3 or 4 shall work on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on three reviews by the review committee constituted by the Head of the Department. The project work is evaluated based on oral presentation and the final project report jointly by a team of examiners including one external examiner.

Total Instructional hours : 60

Course Outcomes : Students will be able to	
❍	On completion of the project work, students will be in a position to take up any challenging practical problem in Agriculture and find solution by formulating proper methodology.



BoS Chairman