B.E. (Agriculture Engineering)

2015 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai
Approved by AICTE – Accredited by NBA New Delhi, NAAC with 'A' Grade and ISO 9001:2008 Certified)
SATHYAMANGALAM – 638 401 Erode District Tamil Nadu
Phone : 04295 226000 Fax : 04295 226666
Web:www.bitsathy.ac.in E-mail : stayahead@bitsathy.ac.in

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REGULATIONS 2015
(CHOICE BASED CREDIT SYSTEM)

(Common to all B.E./B.Tech. Degree Programmes)

Regulation 2015 has been prepared in accordance with the guidelines given by the University Grants Commission, All India Council for Technical Education and affiliating University incorporating the features of the Choice Based Credit System (CBCS). The Regulation 2015 is applicable to the candidates admitted to the Bachelor of Engineering (B.E.) / Bachelor of Technology (B.Tech.) Degree Programmes of the Institution in the academic year 2015-2016 for Regular admission (Academic year 2016-2017 for Lateral Entry) and subsequently.

The regulations hereunder are subjected to amendments as may be decided by the Academic Council of the Institution from time to time. Any or all such amendments will be effective from such date and to such batches of students (including those already in the middle of the programme) as may be decided by the Academic Council.

1. ADMISSION

Candidate, seeking admission to the B.E./B.Tech. Programme, shall satisfy the conditions of admission prescribed by the Directorate of Technical Education and Anna University, Chennai as given below.

1.1 Regular Admission

Candidates, for admission to the first semester of the eight semesters B.E./B.Tech. Degree Programmes, shall be required to have passed:

- Higher Secondary Examination (10 +2) of Curriculum (Regular Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics, and Chemistry as three of the four subjects of the study prescribed under Part-III or any other examinations of any Board or University or authority accepted by the Syndicate of the University / Directorate of Technical Education (DoTE), Chennai as equivalent thereto.

(or)

- Should have passed Higher Secondary Examination of Vocational Stream (Engineering/Technology), prescribed by the Government of Tamil Nadu.

1.2 Lateral Entry Admission

1.2.1 The candidates who possess Diploma in Engineering / Technology awarded by the State Board of Technical Education and Training, Tamil Nadu or its equivalent are eligible to apply for Lateral Entry admission to the third semester of B.E. / B.Tech. Programmes in the branch of study as per the eligibility criteria prescribed by the Directorate of Technical Education from time to time.

(or)

1.2.2 The candidates who possess the Bachelor Degree in Science (B.Sc.) (10+2+3 stream) with Mathematics as a subject in B.Sc. is eligible to apply for Lateral Entry admission to the third semester of B.E./B.Tech. Programmes, as per the eligibility criteria prescribed by the Directorate of Technical Education from time to time. Such candidates shall undergo two additional Engineering subject(s) one each in third and fourth semesters, as bridge courses.

2. PROGRAMMES OFFERED

A candidate may be offered admission to any one of the programmes offered by the Institution for the candidates specified in Clause 1.1 and as per the eligibility criteria of DoTE for the candidates under Clause 1.2 from the list given below:

B. E. Programmes

i. Aeronautical Engineering
ii. Agricultural Engineering
iii. Automobile Engineering
iv. Civil Engineering
v. Computer Science and Engineering
vi. Electrical and Electronics Engineering
vii. Electronics and Communication Engineering
viii. Electronics and Instrumentation Engineering
ix. Mechanical Engineering
x. Mechatronics

B. Tech. Programmes

i. Biotechnology
ii. Fashion Technology
iii. Information Technology
iv. Textile Technology
v. Food Technology

3. STRUCTURE OF THE PROGRAMME

3.1 Every programme shall have a distinct curriculum with syllabi consisting of theory, laboratory, mini-project, life-skills and personality development courses, as prescribed by the respective Boards of Studies, broadly categorized under:

(i) **Basic Science** courses including Mathematics, Physics, Chemistry and further specialization in these subjects

(ii) **Basic Engineering c**ourses including Engineering Graphics, Workshop Practices, Basics of Electrical, Electronics, Civil, Mechanical Engineering, Engineering Mechanics and Computer Programming.

(iii) **Humanities and Social Science c**ourses including Language Courses, Management Courses, Life Skills and Professional Ethics.

(iv) **Professional Courses** include Discipline Core Courses, Professional Electives, Core Electives and Open Electives.

(v) **Employability Enhancement Courses (EEC)** include Project Work and /or Internship, Seminar, Industrial /Practical Training, Value Added and Certificate Courses.

The assortment of different courses shall be designed that the student, at the end of the programme, would be able to be trained not only in his / her relevant professional field but also as a socially mindful human being.

The medium of instruction is English for all the Courses, Examinations, Seminar Presentation, Projects and any other courses that a student registers for.

3.2 Each course is normally assigned a certain number of credits, with 1 credit per lecture period per week, 1 credit for 2 periods of tutorial, 1 credit for 2 periods of laboratory courses, and 1 credit for 2 periods of seminar/project work per week.

3.3 A Diagnostic Test will be administered to all the B.E. / B.Tech. students after the admission to assess the proficiency in English and based on the score they will be brought under two streams namely, Stream A and Stream B. Students under Stream A will study **Communicative English I** and Stream B will study **Basic English I** under Language Elective **I** in the First Semester. In the Second Semester, Stream A will be further divided into two categories based on their English language proficiency assessed in the Continuous Assessment, while the upper segment can

enroll and study **German / Japanese / French / Chinese / Hindi** and the remaining students of that Stream will study **Communicative English II**. The students under Stream B will study **Basic English II** or may opt for **Communicative English II** based on the assessment carried out at the end of the semester I.

3.4 Every student shall be required to opt for **Nine** electives from the list of electives. Students can opt for the electives (Core / Professional / Open Elective) from any branch of B.E/B.Tech. Programmes, besides his / her own discipline courses, during V to VIII Semesters, if he/she satisfies the prerequisite for that particular course.

3.5 However, out of nine electives, every student shall be required to opt for, a minimum of three electives as open electives from the list of open electives of the branch / branches other than his / her branch of specialisation. There shall be no pre-requisite course(s) for such open electives.

3.6 Students can also opt for **one-credit courses** of 15 to 20 hour duration, which will be offered by the experts from the industry on specialised topics. Students can opt for such **one-credit courses** during the semesters I to VII as and when these courses are offered. A student will also be permitted to register the **one-credit courses** offered by other Departments, provided the student has fulfilled the necessary pre-requisites or the courses that may not require any pre-requisites. Under no circumstances, the same one credit course shall be repeated in subsequent semesters in any Department / Centre and a maximum batch size for a given course shall not exceed 40. In the case of disciplines with multiple divisions (intake more than 60) different course(s) shall be offered to other batch(es) of students.

On successful completion of one credit courses, Credits will be indicated in the Grade Sheet, but will not be considered for computing the Cumulative Grade Point Average (CGPA). However, if a student wishes to avail the exemption from any one of the Electives (other than open elective) of the Semester VIII, he / she can do so by exercising his / her option in writing to the respective Head of the Department during the beginning of the VIII Semester, following the equivalence norm, that **one regular elective (**in the **VIII Semester)** is equivalent to **three one-credit courses** completed by the student during the previous semesters, IV to VII. Details of the one credit courses offered by the department shall be forwarded to the Office

of the Controller of Examinations. However one credit courses completed during I to III semesters shall be maintained in the Grade sheet as "Additional credits earned" (not considered for the computation of GPA/CGPA).

3.7 Fast Track System shall enable students to undergo a semester-long Internship or Special Training during Semester VIII. A student who secures a minimum CGPA of 8.50 in Semester IV with no current arrears, as on that date and maintains the CGPA of 8.50 till VI Semester without any arrears shall be eligible to opt for Fast Track System and such student is required to complete three elective courses satisfactorily, while completion of Semester VII, as additional Credits during the semesters V to VII.

3.8 Every student shall be required to carry out a Project Work in the Department / Industry or by exercising Fast track during VIII Semester in consultation with the Faculty Guide and submit the project report, in the prescribed format, at the end of the VIII Semester for the valuation.

3.9 A student can register for Self-Study Elective(s) over and above the electives from any branch of Engineering / Technology at the rate of one per semester starting from V semester onwards provided he/she maintains a Cumulative Grade Point Average (CGPA) of 8.50 or above till the previous semesters with no current arrears. Credits will be indicated for such courses in the grade sheets (additional credits) but will not be considered for computing the CGPA.

3.10 A Student may be permitted to credit online courses with the approval of the Departmental Consultative Committee constituted by the Head of the Department, subject to a maximum of three credits. Such students may be exempted from attending the classes, if such course(s) are offered in the semester. Summary of such on-line courses, taken by the students, along with the offering agency shall be presented to the Academic Council for information and further suggestions. However, those students need to obtain certification from the agency / agencies offering the course, to become eligible for writing or seeking exemption (core elective course) from the End Semester Examination. In case of credits earned through online mode, from the other Institute / University, the credits may also be transferred directly after due approval from the Departmental Consultative

Committee and the Office of the Controller of Examinations. A student can get exemption for a maximum of 3 credits during the entire programme (in lieu of Discipline elective or Open elective).

4. VALUE ADDED COURSES / ADD-ON COURSES

A Student can opt for the Value Added Courses / Add-on Courses offered by the various Department / Centres for which the batch size will not exceed 40 per course from Semester II to VII. Head of the Department / Centre shall submit the list of such courses, duly approved / ratified by the Academic Council, to the Controller of Examinations to administer the examination process. A separate Certificate will be issued on successful completion of the course by the Office of the Controller of Examinations.

5. DURATION OF THE PROGRAMME

5.1 A regular student (admitted after 10+2) or equivalent is normally expected to satisfactorily fulfil the requirements for award of the degree B.E. / B.Tech. within four academic years (8 semesters) from the date of admission but in any case not more than 7 years (14 Semesters); lateral entry students shall fulfil such requirements within three academic years (6 semesters) from the date of admission but in any case not more than six years (12 Semesters) leading to the award of Degree of Bachelor of Engineering (B.E.) / Bachelor of Technology (B.Tech.) of Anna University, Chennai.

5.2 The total period for completion of the programme from the commencement of the semester, to which the student was admitted, shall not exceed the maximum period (Clause 5.1), regardless to the break-of-study (vide Clause 15) or period of prevention in order.

5.3 Each semester shall consist of minimum 90 working days or 450 periods of 60 minutes each or equivalent. Head of the Department shall ensure that every faculty member teaches the subject / course as prescribed in the approved curriculum and syllabi.

5.4 Special Theory / Practical Sessions may be conducted for students who require additional inputs over and above the number of periods normally specified

(Remedial Classes), as decided by the Head of the Department, within the specified duration of the Semester / Programme.

6. COURSE ENROLLMENT AND REGISTRATION

6.1 Each student, on admission shall be assigned to a Faculty Advisor (vide Clause 8) who shall advise / counsel the student about the details of the academic programme and the choice of course(s) considering the student's academic background and career objectives.

6.2 Every student shall enroll for the courses of the succeeding semester, in the current semester. However, the student shall confirm the enrollment by registering for the courses within the first five working days after the commencement of the semester concerned.

6.3 After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Assessment marks and appear for the End Semester Examinations.

6.3.1 Each student, on admission to the programme, shall register for **all the courses prescribed in the curriculum in** the **first Semester of study (III Semester** for students admitted under **lateral entry stream).**

6.3.2 The enrollment for all the courses of the Semester II will commence 10 working days prior to the last working day of Semester I. The student shall confirm the enrollment by registering for the courses within the first five working days after the commencement of the Semester II. In the case, if a student fails to register in the course(s), he/ she may be permitted to register the same, as specified in the Clause 6.5, in the subsequent semesters or when it is offered.

6.3.3 The enrollment for the courses of the Semesters III to VIII will commence 10 working days prior to the last working day of the preceding semester. The student shall enroll for the courses with the guidance of the student's Faculty Advisor. If a student wishes, the student may drop or add courses (vide Clause 6.4) within **five** working days after the commencement of the semester concerned and complete the registration process duly authorized by the Faculty Advisor.

6.4 Flexibility to Add or Drop courses

6.4.1 A student has to earn the total number of credits specified in the Curriculum of the respective Programme of study in order to be eligible to obtain the degree. However, if a student wishes, the student is permitted to earn more than the total number of credits prescribed in the curriculum by opting for one- credit courses, self study electives or additional courses.

6.4.2 From the III to VIII semesters (from IV to VIII Semesters in case of lateral entry students), the student has the option of registering for additional courses or dropping existing courses. Total number of credits of such courses cannot exceed 6 in a given Semester. However the maximum number of credits that a student can register in a particular semester shall not exceed 30 credits (regardless to the reappearance credits). In such cases, the attendance requirement as stated Clause 7 is mandatory.

6.4.3 The minimum number of credits that a student can register in a particular semester shall not be less than 18 credits (except VII / VIII semester).

6.4.4 The student shall register for the project work in the VIII semester only.

6.5 Reappearance Registration

6.5.1 If a student fails in a theory course, the student shall do reappearance registration (Examination) for that course in the subsequent semesters or when it is offered next.

6.5.2 On registration, a student may attend the classes for the reappearance registration courses, if the student wishes, and the attendance requirement (vide Clause 7) is not compulsory for such courses.

6.5.3 However, if a student wishes to improve his/ her continuous assessment, in the second attempt during reappearance, shall satisfy the Clause 6.5.5 and appear for continuous assessment as given for that particular course.

6.5.4 If the theory course, in which the student has failed, is either 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. However, the change of elective courses is permitted only once.

6.5.5 In this case (Clause 6.5.4), the student shall attend the classes, satisfy the attendance requirements (vide Clause 7), earn Continuous Assessment marks and appear for the End Semester Examination.

6.5.6 The student who fails in any Laboratory Course/ Project work / Seminar or any other EEC courses (Specified in Clause 3.1) shall register for the same in the subsequent semesters or when offered next, and **repeat** the course as per Clause 6.5.5.

6.5.7 If a student is prevented from writing the end semester examination of a course or several courses due to lack of attendance, the student has to register for that / those course(s) again, when offered next, attend the classes and fulfill the requirements as per Clause 6.5.5 & 6.5.6. If the course, in which the student has 'lack of attendance', is a Core Elective or an Open Elective, the student may register for the same or any other Core Elective or Open Elective course(s) respectively in the subsequent semesters and appear in the examination as per Clause 6.5.5.

7. REQUIREMENTS FOR APPEARING FOR THE END SEMESTER EXAMINATION OF A COURSE

A student who has fulfilled the following conditions (vide Clause 7.1 and 7.2) shall be deemed to have satisfied the attendance requirements for appearing for End Semester Examination of a particular course.

7.1 Every student is expected to attend all the periods and earn 100% attendance. However, a student shall secure not less than 80% attendance course wise taking into account the number of periods required for that course as specified in the curriculum.

7.2 If a student, secures attendance between 70% and 79% in any course(s) in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) or participation in Institution/ University/ State/ National/ International level extra and co-curricular activities, with prior permission from the Head of the Department, shall be permitted to appear for the current semester examinations subject to the condition that the student shall submit the medical certificate / participation certificate attested by the Head of the Department (along

with Condonation form). Such certificates along with the condonation forms shall be forwarded to the Controller of Examinations for verification and permission to attend the examinations. However during the entire programme of study, a student can avail such Condonation in any two semesters only (regardless the number of courses).

7.3 A student shall normally be permitted to appear for End Semester Examination of the course(s) if the student has satisfied the attendance requirements (vide Clause 7.1 – 7.2) and has registered for examination in those courses of that semester by paying the prescribed fee.

7.4 Students who do not satisfy Clause 7.1 and 7.2 and who secure less than 70% attendance in a course will not be permitted to write the End-Semester Examination of that course. The student has to register and repeat this course in the subsequent semesters or when it is offered next (vide Clause 6.5).

7.5 In the case of reappearance registration for a course (vide Clause 6.5), the student has to register for examination in that course by paying the prescribed fee.

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

8. FACULTY ADVISOR

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a Faculty member of the Department who shall function as Faculty Advisor for those students. The Faculty Advisor shall advise and guide the students in registering of courses, reappearance of courses, monitor their attendance and progress and counsel them periodically. If necessary, the Faculty Advisor may also discuss with or inform the parents about the progress / performance of the students concerned.

9. COMMITTEES

9.1 Common Course Committee

9.1.1 A theory course handled by more than one faculty including the discipline with multiple divisions (greater than or equal to 2) shall have a "Common Course Committee" comprising of all members of faculty teaching that course with one

of the members as the Course Coordinator, nominated by the Head of the Institution (Head of the Department in the case of multiple divisions of a discipline) and student representatives (one per specialization or division) registered for that course in the current semester.

First meeting of the Common Course Committee shall be held within fifteen days from the date of commencement of the semester. Two 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 all the students.

9.1.2 In addition, Common Course Committee (without the student representatives) shall meet to ensure uniform evaluation through the common question papers during Continuous Assessment and End Semester Examinations.

9.2 Class Committee Meeting

For all the courses taught, prescribed in the curriculum, Class Committee meeting shall be convened thrice in a semester (first meeting within 15 days from the commencement of the semester and other two meetings at equal interval after the first meeting) comprising members of the faculty handling all the courses and two student representatives from the class.

One of the members of the faculty (preferably not handling any courses to that class), nominated by the Head of the Department, shall coordinate the activities of the Committee. 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 all other students.

10. SYSTEM OF EXAMINATION

10.1 Performance in each course of study shall be evaluated based on (i) Continuous Assessment throughout the semester and (ii) End Semester examination at the end of the semester for the regular courses or as given in the Clause 16. However, the

final examination in the case of one credit courses / certificate / value added courses may be conducted, as and when the course is completed, through the office of the Controller of Examinations.

10.2 Each course, both theory and practical including project work, shall be evaluated as per the Scheme of Assessment given in Clause 16.

10.3 The End Semester Examinations shall normally be conducted after satisfying the Clause 5.2. Supplementary Examinations may also be conducted, at such times, for the benefit of the students as decided by the Controller of Examinations.

10.4 For the End Semester examinations, both theory and practical courses including project work, the internal and external examiners (from Academia or Industry) shall be appointed by the Controller of Examinations as per the guidelines given by the Examination and Evaluation Board of the Institute.

11. PASSING REQUIREMENTS AND PROVISIONS

11.1 A student who secures not less than 50% of total marks prescribed for a course, vide Clause 16, comprising a minimum of 50% of the marks prescribed for the End Semester Examination, shall be declared to have passed the course successfully and earned the prescribed credits for that course, applicable for all registered courses.

11.1.1 If a student fails to secure a pass in a particular course, i.e., failing to obtain minimum marks, as stated above, it is mandatory that he/she shall register and reappear for the examination in that course in the subsequent semester(s) whenever the examinations are conducted for that course, till he / she secures a 'Pass'.

11.1.2 Continuous Assessment (CA) marks obtained by the student in the first appearance shall be retained and considered valid for one subsequent attempt, except Clause 6.5.4, 6.5.5, 6.5.6 and 6.5.7. However, from the third attempt onwards, the student shall be declared to have passed the course if he/she secures a minimum of 6 Grade Points (B Grade) in the course prescribed during the End Semester Examinations.

11.2 The minimum number of total credits to be earned by a student to qualify for the award of Degree in the various branches of study as prescribed by the respective Boards of Studies is given below:

Branch of Study	Minimum Credits	
	Regular Admission	Lateral Entry
B.E. Programmes		
Aeronautical Engineering	178	134
Agricultural Engineering	177	133
Automobile Engineering	179	134
Civil Engineering	176	131
Computer Science and Engineering	176	131
Electrical and Electronics Engineering	176	132
Electronics and Communication Engineering	177	132
Electronics and Instrumentation Engineering	177	133
Mechanical Engineering	179	135
Mechatronics	177	133
B.Tech. Programmes		
Biotechnology	175	131
Fashion Technology	176	132
Information Technology	176	131
Textile Technology	175	131
Food Technology	175	131

11.2.1 Student Migration and Credit Transfer: Normalization of the Credits will be carried out in consultation with the Board of Studies of the programme concerned and approved by the Head of Institution, if a student migrates from other institutions to Bannari Amman Institution of Technology or rejoins from previous regulation to this regulation.

11.3 A student shall be declared to have qualified for award of B.E/B.Tech. Degree if he/she successfully completes the course requirements (vide Clause 7, 10 and 11) and passed all the prescribed courses of study of the respective programme (listed in Clause 2), within the duration specified in Clause 5.1.

12. ASSESSMENT AND AWARD OF LETTER GRADES

12.1 The assessment shall be based on the performance in the End Semester Examinations and / or Continuous Assessment, carrying marks as specified in Clause 16. Letter Grades (based on Credit Point and Grade Point) are awarded to the students based on the performance in the evaluation process.

12.2 Credit Point is the product of Grade Point and number credits for a course and Grade Point is a numerical weight allotted to each letter grade on a 10-point scale (as specified in the Clause 12.3), while the Letter Grade is an index of the performance of a student in a said course.

12.3 The performance of a student will be reported using Letter Grades, each carrying certain points as detailed below:

specified in Clause 16) /	Grade Points	Letter Grade
91 to 100	10	O (Outstanding)
81 to 90	9	A + (Excellent)
71 to 80	8	A (Very Good)
61 to 70	7	B + (Good)
50 to 60	6	B (Above average)
0 to 49	0	RA (Reappearance Registration)
Incomplete	0	I
Withdrawal	0	W
Absent	0	AB
Shortage of Attendance	0	SA

'RA' ---Reappearance registration is required for that particular course

'I' --- Continuous evaluation is required for that particular course in the subsequent examinations.

'SA' --- shortage of attendance (Clause 7) and hence prevented from writing end semester examination.

12.4 After completion of the evaluation process, Grade Point Average (GPA), and the Cumulative Grade Point Average (CGPA) is calculated using the formula:

$$GPA/CGPA = \frac{\sum_{1}^{n} C_i * g_i}{\sum_{1}^{n} C_i}$$

where

C_i : Credit allotted to the course.

g_i : Grade Point secured corresponding to the course.

n : number of courses successfully cleared during the particular semester in the case of GPA and all the semesters, under consideration, in the case CGPA.

12.5 A student who does not appear for the End Semester Examinations in a course, after registering for the same, shall be deemed to have appeared for that examination for the purpose of classification (Subject to Clause 14 and 15).

12.6 For the non credit courses Grades shall be indicated as given in the Clause 16 and shall not be counted for the computation of GPA/CGPA.

12.7 **Photocopy / Revaluation:** A student, who seeks the re-valuation of the answer script is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s), within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses. In the case of theory courses with laboratory component, a student can seek revaluation for the theory component only, following the procedure stated above.

13. CLASSIFICATION OF THE DEGREE AWARDED

For the purpose of the 'Award of Degree', the duration of completion of the programme shall be the total duration taken by a student for completing first time registration of all the required courses and satisfying Clause 11, regardless to the period of Break-of-study as per Clause 15 and satisfy any one of the conditions required as given below.

13.1 **First Class with Distinction**: A student who qualifies for the award of the Degree having passed all the courses of study of all the Eight Semesters (six semesters for lateral entry students) at the first opportunity, after the commencement of his / her study and securing a CGPA not less than 8.50 (vide clause 12.3) shall be declared to have passed with **First Class with Distinction**.

13.2 **First Class**: A student who qualifies for the award of the Degree having passed all the courses of study of all the eight semesters (six semesters for lateral entry students) after the commencement of his / her study and securing a CGPA not less than 6.50 shall be declared to have passed with **First Class** (not exceeded the total duration as specified in the Clause 5).

13.3 **Second Class**: All other students who qualify for the award of the Degree shall be declared to have passed in **Second Class.**

13.4 Course Completion Certificate shall be given to a student, provided he / she should have registered all the courses and also registered for the examinations in those courses (subject to Clause 6.0 and 7.0).

14. WITHDRAWAL FROM THE EXAMINATION

14.1 A student may, for valid reasons, be granted permission by the Head of the Department to withdraw from appearing in the examination in any course(s) only once during the entire duration of the degree programme.

14.2 Withdrawal application shall be valid only, if the student is eligible to write the examination as per Clause 7 and, if such request for withdrawal is made prior to the submission of the Continuous Assessment marks of the course(s) with the recommendations from the Head of the Department.

14.3 Withdrawal shall not be considered as an appearance in the examination for the eligibility of a student for First Class with Distinction or First Class.

15. AUTHORIZED BREAK OF STUDY FROM A PROGRAMME

15.1 A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

15.2 A student is normally not permitted to break the period of study temporarily. However, if a student happens to discontinue the programme temporarily during the

middle of programme of study, for reasons such as personal accident or hospitalization due to ill health or in need of health care, he/she shall apply to the Head of the Institution in advance, in any case, not later than the last date for registering for the semester examination, through the Head of the Department stating the reasons for the break-of-study (for one academic semester or 6 months, whichever is earlier). However, a student detained for want of minimum attendance requirement as per Clause 7 shall not be considered as permitted 'Break of Study' and Clause 15.3 is not applicable for such case.

15.3 The student is permitted to rejoin the programme after the break shall be governed by the rules and regulations of DoTE and the Curriculum and Regulations in force at the time of rejoining, subject to the Clause 11.2.1.

15.4 Authorized break of study will be counted towards the duration specified for passing all the courses (vide Clause 5.1 and 5.2) and for the purpose of classification of Degree (vide Clause 13).

15.5 The total period for completion of the programme reckoned from the commencement of the first semester to which the student is admitted shall not exceed the maximum period specified in Clause 5.1, irrespective of the period of break of study in order that he / she may be eligible, for the award of the degree (vide Clause 13).

15.6 In case of valid reasons (as stated in Clause 15.2) extended break-of-study may be granted by the Head of the Institution for a period not more than one year (total duration or two semesters whichever is earlier) in addition to the earlier authorized break of study.

15.7 If a student does not report back to the Institute, even after the extended Break of Study, the name of the student shall be deleted permanently from the college enrollment. Such students are not entitled to seek readmission under any circumstances.

16. SCHEME OF ASSESSMENT

Courses offered under B.E. / B.Tech. Programmes are assessed as given below:

I	**THEORY COURSES**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Test I (15)	
	Test II (15)	
	Open book test (10)	
	Library - Seminars / Assignments (Two) (10)	
	End Semester Examination	**50**
	Total Marks	**100**

II	**THEORY COURSES WITH LAB COMPONENT**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Test I (10)	
	Test II (10)	
	Conduct of Experiment	
	Preparation(5)	
	Experiment and Results (5)	
	Record Note[#]	
	Final Lab Examination (20)	
	End Semester Examination (QP pattern as per (I))	**50**
	Total Marks	**100**

III	**LABORATORY COURSES**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Conduct of Experiment	
	i. Preparation (5)	
	ii. Experiment and Results (10)	
	iii. Record / Observation[#] *(5)*	
	Test – Cycle I (15)	
	Test – Cycle II (15)	
	End Semester Examination *Experiments & Results (40)* *Viva Voce – (10)*	**50**
	Total Marks	**100**

[#] *Reports / Record Note / Integrated Lab Manual to be retained for 1 year for Academic Audit, by respective Department*

IV	**TECHNICAL SEMINAR**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Presentation I (25)	
	Presentation II (25)	
	End Semester Examination	
	Report[#] *(20)*	**50**
	Presentation (20)	
	Viva voce (10)	
	Total Marks	**100**

V	**PROJECT**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Literature survey (10)	
	Problem Identification (5)	
	Methodology (10)	
	Review II	
	Continuation in Methodology (10)	
	Results/ Progress (15)	
	End Semester Examination	
	Report[#] *(20)*	**50**
	Presentation (20)	
	Viva voce (10)	
	Total Marks	**100**

VI	**LANGUAGE ELECTIVE (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test 1	
	Listening (10)	
	Speaking (5)	**25**
	Reading (5)	
	Writing (5)	
	Test 2	
	Listening (10)	
	Speaking (5)	**25**
	Reading (5)	
	Writing (5)	
	Oral Exam	**50**
	Total Marks	**100**

[#] *Reports / Record Note / Integrated Lab Manual to be retained for 1 year for Academic Audit, by respective Department*

VII	**ONE-CREDIT COURSE**	**Marks**
	Test	**30**
	Quiz	**20**
	Final Examination	**50**
	Total Marks	**100**

VIII	**MINI-PROJECT**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Review I	**25**
	Review II	**25**
	Project Evaluation	
	Report (25)[#]	**50**
	Presentation&Viva Voce (25)	
	Total Marks	**100**

IX	**LIFE SKILLS**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Test I	**25**
	Test II	**25**
	Final Examination	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory/Not Satisfactory)	

X	**VALUE ADDED / CERTIFICATE COURSES**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Test I	**25**
	Test II	**25**
	Final Evaluation / Test	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory / Not Satisfactory)	

XI	**ENGINEERING GRAPHICS**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Class work (based on attendance) (5) *Assignments (Minimum 8 Assignments) (20)* *Model Examination (25)*	
	End Semester Examination	**50**
	Total Marks	**100**

[#] *Reports / Record Note / Integrated Lab Manual to be retained for 1 year for Academic Audit, by respective Department*

Optional Test: *A student becomes eligible to appear for the one optional test conducted after the Periodical Test II, only under the following circumstances: (i) absent for Test I or Test II or both on account of medical reasons (hospitalization / accident / specific illness), or (ii) participation in the College / University / State / National / International level Sports events with prior permission from the Head of the Institution and (iii) on satisfying the conditions (i) or (ii), the student should have registeredfor the Optional Test, through the concerned member of faculty who handles the course or through the respective Head of the Department, submitted to the Controller of Examinations. Such Optional Tests are not conducted for the courses under the categories III, IV, V, VI, VII, VIII, IX, X and XI listed above.*

17. FIELD / INDUSTRIAL VISIT / INTERNSHIP

Heads of Departments, in order to provide the experiential learning to the students, shall take efforts to arrange at least two industrial visits / field visits in a semester. The students may also undergo in-plant training / internship during summer / winter vacation between III and VII semesters.

18. PERSONALITY AND CHARACTER DEVELOPMENT

Every student shall be required to undergo a minimum of 40 hours of Personality Development Programmes viz, NSS / NCC / YRC / YOGA / Sports and Games / Technical and Non-technical Club activities during the first year, failing which he/she shall not be permitted to appear for the End Semester examinations of semester II and there onwards. Such students are permitted to appear for the End Semester examinations of semester II and there onwards only after completing satisfactorily the requirements.

The attendance of the personality and character development courses / events shall be maintained on the regular basis by the concerned First Year Co-ordinators and made available in the Office of the Controller of Examinations before the commencement of Semester examinations of Semester I or Semester II.

19. DISCIPLINE

A student is expected to follow the rules and regulations laid down by the Institute and the affiliating University, as published from time to time. Any violations, if any, shall be treated as per the procedures stated thereof.

If a student indulges in malpractice in any of the End Semester / Continuous Assessments, he / she shall be liable for punitive action as prescribed by the Institution / University from time to time.

20. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The Institution reserves the right to revise/amend/change the Regulations, Curriculum, Syllabi, Scheme of Examinations and date of implementation and to introduce Additional Electives, Open Electives, One Credit Courses and Value Added Courses through the Academic Council.

The Question Paper pattern (Theory Examination) for UG Programme is given below:

PART A

Objective Type Questions: 20	**(20X1 = 20 Marks)**	**20**

PART B

Short Answer Questions: 10	**(10X2 = 20 Marks)**	**20**

PART C

Long Answer Questions: 5	**(5X12 = 60 Marks)**	**60**

	Total	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the B.E. Agricultural Engineering will be able to

1. Acquire knowledge and skill in solving problems in Agriculture through engineering approach
2. Analyze and improve agricultural operations through farm mechanization, land and water management, crop processing, post-harvest handling and energy conservation
3. Develop professionalism in management, entrepreneurship, continuous learning and follow ethics to serve the society

PROGRAMME OUTCOMES (POs)

a. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

k. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

Mapping of PEOs and POs

PEO	Programme Educational Objective(s)	Program Outcome(s)
I	To acquire training and knowledge in design and engineering problems solving approach in agriculture based on understanding of engineering science including mathematics, physics and biology	(a), (b), (c) (d) and (e)
II	Acquire an adequate knowledge to make farming sustainable, self and environmentally friendly. They analyze agricultural operation and weigh the use of new technique and methods to increase yields, improve land use and conserve resource like seed, water, fertilizer, pesticide and fuel	(a), (b),(c), (d), (e), (f), (h) and (i)
III	To improvise better ways to minimize the crop loss from field damage during handling, sorting, processing and packaging	(a),(b),(c), (d) and (e)
IV	To acquire good knowledge in ICT(Information and Communication Technology), teamwork and instrumentation.	(d),(f),(g), (h) (i) and (j)

CURRICULUM 2015

B.E. AGRICULTURE ENGINEERING

Minimum Credits to be Earned: 177

FIRST SEMESTER

Code No.	Course	Objectives &		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA101	MATRICES AND CALCULUS*	I, II	a,b	3	2	0	4	50	50	100	BS
15PH102	ENGINEERING PHYSICS*	I, II	a	2	0	2	3	50	50	100	BS
15CH103	ENVIRONMENTAL SCIENCE*	I, II	g	2	0	2	3	50	50	100	HSS
	LANGUAGE ELECTIVE I#	-	-	-	-	-	3	100	-	100	HSS
15GE105	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING$^{\Delta}$	I, II	a	2	0	2	3	50	50	100	ES
15AG106	FUNDAMENTALS OF SOIL SCIENCE	I, II	a, b	2	0	2	3	50	50	100	PC
15GE107	WORKSHOP PRACTICE$^{\Omega}$	I, II	a, e	0	0	2	1	50	50	100	ES
		Total		11	2	10	20	**400**	**300**	**700**	-

SECOND SEMESTER

Code No.	Course	Objectives &		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA201	VECTOR CALCULUS AND COMPLEX ANALYSIS*	I, II	a,b	3	2	0	4	50	50	100	BS
	PHYSICS ELECTIVE*	-	-	-	-	-	4	50	50	100	BS
	CHEMISTRY ELECTIVE*	-	-	-	-	-	4	50	50	100	BS
	LANGUAGE ELECTIVE II#	-	-	-	-	-	3	100	-	100	HSS
15AG205	ENGINEERING GEOLOGY AND SOIL MECHANICS	I, II	g	2	0	2	3	50	50	100	PC
15GE206	COMPUTER PROGRAMMIN	I, II	a, c	3	0	2	4	50	50	100	ES
15GE207	ENGINEERING GRAPHICS$^{\Psi}$	I, II	a, b, d, e	0	0	4	2	50	50	100	ES
		Total		8	2	8	24	**400**	**300**	**700**	-

*Common to all branches of B.E./B.Tech
#Common to all branches of B.E./B.Tech (Continuous Assessment)
$^{\Delta}$Common to AE,AG,AU,CE,ME,MTRS, BT,TT,FD (I Semester) and to CSE,FT,IT (II Semester)
$^{\Omega}$Common to AE, AG,AU,ME,MTRS, BT,FT,TT ,FD (I Semester) and to CE,CSE,ECE,EEE,EIE,IT (II Semester)
$^{\Psi}$Common to CE (I Semester) and to AE,AG,AU, ME,MTRS, BT,FT,TT,FD (II Semester)
$^{\lambda}$Common to CE,CSE,ECE,EEE,EIE,IT (I Semester) and to AE, AG,AU,ME,MTRS, BT,FT,TT, FD (II Semester)

THIRD SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA301	FOURIER SERIES AND	I, II	a,b	3	2	0	4	50	50	100	BS
15AG302	ENGINEERING THERMODYNAMICS	I, II	a,b,c,e,f,g,i,j	3	2	0	4	50	50	100	ES
15AG303	ENGINEERING MECHANICS	I, II	a,b,c,e,f,g,i,j	3	2	0	4	50	50	100	ES
15AG304	FLUID MECHANICS AND MACHINERY	I, II	a,b,c,d,i,j.k	3	0	0	3	50	50	100	ES
15AG305	ENGINEERING SURVEY	I, II	a,b,d,e,g,i,j,	3	0	0	3	50	50	100	ES
15AG306	SOIL AND WATER CONSERVATION ENGINEERING	I, II	a,b,e,f,g,h	2	2	0	3	50	50	100	PC
15AG307	FLUID MECHANICS AND MACHINERY	I, II,III	a,b,c,d,i,j,k,	0	0	2	1	50	50	100	ES
15AG308	ENGINEERING SURVEY LABORATORY	I, II,III	a, b,d,e,g,i,l	0	0	2	1	50	50	100	ES
15AG309	MINI PROJECT I	II, III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE310	LIFE SKILLS: BUSINESS	III	j	0	0	2	-	100	-	100	EEC
Total				17	8	8	24	**600**	**400**	**1000**	-

FOURTH SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA401	NUMERICAL METHODS AND STATISTICS[α]	I, II	a,b,c,f,i,j,l	2	2	0	3	50	50	100	BS
15AG402	THEORY OF MACHINES	I, II	a,b,c,e,f,g,i,j,l	3	0	0	3	50	50	100	ES
15AG403	HEAT AND MASS TRANSFER	I, II	a,b,c,e,f,g,i,j,l	2	0	2	3	50	50	100	ES
15AG404	STRENGTH OF MATERIALS	I, II	a,b,c,e,f,g,i,j,l	3	2	0	4	50	50	100	ES
15AG405	DESIGN OF FARM STRUCTURES	I, II	a,b,c,f,g,h,i,j,	3	0	0	3	50	50	100	PC
15AG406	IRRIGATION AND DRAINAGE	I, II	a,b,c,d,e,g,i,j,	3	0	0	3	50	50	100	PC
15AG407	CROP HUSBANDRY LABORATORY	I, II, III	a,b,c,d,e,f,g,i,j	0	0	4	2	50	50	100	PC
15AG408	IRRIGATION AND DRAINAGE	I, II, III	a,b,c,d,e,g,i,j,	0	0	2	1	50	50	100	PC
15AG409	MINI PROJECT II	II, III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE410	LIFE SKILLS: VERBAL	III	j	0	0	2	-	100	-	100	EEC
Total				16	4	12	23	**600**	**400**	**1000**	-

[α] Common to all branches of B.E./B.Tech. except CSE
[Φ] Common to all branches of B.E./B.Tech (Non-Credit Course)
[β] Common to AG,AU,ME,MTRS,EEE,EIE,BT,TT,FT,FD

FIFTH SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15AG501	UNIT OPERATIONS IN FOOD PROCESS ENGINEERING	I, II	a,b,c,d,e,g,i,j,l	3	0	0	3	50	50	100	PC
15AG502	TRACTORS AND FARM ENGINES	I, II	a,b,c,d,e,g,i,j,l	3	0	0	3	50	50	100	PC
15AG503	FARM IMPLEMENTS AND EQUIPMENT	I, II	a,b,c,d,e,,i,j,l	3	0	2	4	50	50	100	PC
15AG504	HYDROLOGY	I, II	a,b,c,d,e,g,i,j,l	3	2	0	4	50	50	100	PC
	ELECTIVE I	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE II	-	-	-	-	-	3	50	50	100	PE
15AG507	UNIT OPERATIONS IN FOOD PROCESS ENGINEERING LABORATORY	I, II, III	a,b,c,d,e,g,i,j,l	0	0	2	1	50	50	100	PC
15AG508	TRACTORS AND FARM ENGINES	I, II, III	a,b,c,d,e,g,i,j,l	0	0	2	1	50	50	100	PC
15AG509	TECHNICAL SEMINAR I	II, III	i,j	0	0	2	1	50	50	100	EEC
15AG510	MINI PROJECT III	II, III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE511	LIFE SKILLS: APTITUDE I[Φ]	III	a,b	0	0	2	-	100	-	100	EEC
Total				12	2	12	24	**650**	**450**	**1100**	-

SIXTH SEMESTER

Code No.	Course	Objectives &		L	T	P	C	Maximum Marks			
		PEOs	POs					CA	ES	Total	Category
15AG601	TRANSFER OF TECHNOLOGY	II, III	f,g,h,i,j,l	2	0	0	2	50	50	100	PC
15AG602	CROP PROCESS ENGINEERING	I, II	a,b,c,d,e,g,i, j,l	3	0	0	3	50	50	100	PC
15AG603	DESIGN OF AGRICULTURAL MACHINERY	I, II	a,b,c,d,e,g.i, j,l	3	0	0	3	50	50	100	PC
15AG604	DESIGN OF MICRO IRRIGATION	I, II	a,b,c,d,e,g,i, j,l	2	2	0	3	50	50	100	PC
	ELECTIVE III	-		-	-	-	3	50	50	100	PE
	ELECTIVE IV	-		-	-	-	3	50	50	100	PE
15AG607	CROP PROCESS ENGINEERING LABORATORY	I, II, III	a,b,c,d,e,g,i, j,l	0	0	2	1	50	50	100	PC
15AG608	COMPUTER AIDED MODELING LABORATORY	I, II, III	a,b,c,d,e,i,j,l	0	0	2	1	50	50	100	PC
15AG609	TECHNICAL SEMINAR II	II,III	j	0	0	2	1	50	50	100	EEC
15AG610	MINI PROJECT IV	II,III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE611	LIFE SKILLS: APTITUDE II[Φ]	III	a,b	0	0	2	-	100	-	100	EEC
Total					10	2	10	21	**650**	**450**	**1100**

[Φ]Common to all branches of B.E./B.Tech (Non-Credit Course)

SEVENTH SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			
		PEOs	POs					CA	ES	Total	Category
15GE701	AGRICULTURAL ECONOMICS[$]	III	a,b,c,e,k,l	3	0	0	3	50	50	100	HSS
15AG702	FOOD AND DAIRY ENGINEERING	I, II	a,b,c,d,e,g,i,j, k, l	3	0	0	3	50	50	100	PC
15AG703	RENEWABLE ENERGY RESOURCES	I, II	a,b,c,d,e,g,i,j, k, l	3	0	2	4	50	50	100	PC
15AG704	RS AND GIS FOR NATURAL	I, II	a,b,c,d,e,g,i,j, k, l	3	0	2	4	50	50	100	PC
	ELECTIVE V	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE VI	-	-	-	-	-	3	50	50	100	PE
15AG707	FOOD AND DAIRY ENGINEERING LABORATORY	I, II, III	a,b,c,d,e,g,i,j, k, l	0	0	2	1	50	50	100	PC
15AG708	OPERATION AND MAINTENANCE OF TRACTOR AND FARM IMPLEMENTS LABORATORY	I, II, III	a,b,c,d,e,,i,j, l	0	0	2	1	50	50	100	PC
15AG709	MINI PROJECT V	II,III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE710	LIFE SKILLS : COMPETITIVE EXAMS[Φ]	III	a,b,l	0	0	2	-	100	-	100	EEC
Total				12	0	12	23	**600**	**400**	**1000**	-

EIGHT SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			
		PEOs	POs					CA	ES	Total	Category
	ELECTIVE VII	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE VIII	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE IX	-	-	-	-	-	3	50	50	100	PE
15AG804	PROJECT WORK	I,II,III	a-l	-	-	-	9	50	50	100	EEC
Total				-	-	-	**18**	**200**	**200**	**400**	-

[$]Common to CSE,ECE,EEE,EIE,IT (VI Semester) and to AE, AG,AU,CE,ME,MTRS,BT,FT,TT, FD (VII Semester)

[Φ]Common to all branches of B.E./B.Tech (Non-Credit Course)

ELECTIVES							
Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
LANGUAGE ELECTIVES							
15LE101	BASIC ENGLISH I	III	j	3	0	0	3
15LE102	COMMUNICATIVE ENGLISH I	III	j	3	0	0	3
15LE201	BASIC ENGLISH II	III	j	3	0	0	3
15LE202	COMMUNICATIVE ENGLISH II	III	j	3	0	0	3
15LC203	CHINESE	III	j	3	0	0	3
15LF203	FRENCH	III	j	3	0	0	3
15LG203	GERMAN	III	j	3	0	0	3
15LH203	HINDI	III	j	3	0	0	3
15LJ203	JAPANESE	III	j	3	0	0	3
PHYSICS ELECTIVES							
15PH201	PHYSICS OF MATERIALS	I	a	3	0	2	4
15PH202	APPLIED PHYSICS	I	a	3	0	2	4
15PH203	MATERIALS SCIENCE	I	a	3	0	2	4
15PH204	PHYSICS OF ENGINEERING MATERIALS	I	a	3	0	2	4
15PH205	SOLID STATE PHYSICS	I	a	3	0	2	4
CHEMISTRY ELECTIVES							
15CH201	ENGINEERING CHEMISTRY	I	a	3	0	2	4
15CH202	APPLIED CHEMISTRY	I	a	3	0	2	4
15CH203	APPLIED ELECTROCHEMISTRY	I	a	3	0	2	4
15CH204	INDUSTRIAL CHEMISTRY	I	a	3	0	2	4
15CH205	WATER TECHNOLOGY AND GREEN CHEMISTRY	I	a	3	0	2	4
DISCIPLINE ELECTIVES							
15AG001	BUILDING MATERIALS, ESTIMATION AND COSTING	I, II	a,c,e,i,j,l	3	0	0	3
15AG002	REFRIGERATION AND AIR CONDITIONING	I, II	a,b,c,d,e,f,	3	0	0	3
15AG003	STORAGE AND PACKAGING TECHNOLOGY	I, II	a,b,c,d,e,g,	3	0	0	3
15AG004	TECHNOLOGY OF SEED PROCESSING	I, II	a,b,c,d,e,g,	3	0	0	3
15AG005	FAT AND OIL PROCESSING	I, II	a,b,c,d,e,g,	3	0	0	3
15AG006	HORTICULTURAL CROP PROCESS ENGINEERING	I, II	a,b,c,d,e,g,	3	0	0	3

15AG007	SUGAR TECHNOLOGY	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG008	BIO AND THERMO CHEMICAL CONVERSION OF BIOMASS	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG009	SOLAR AND WIND ENGINEERING	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG010	ENERGY CONSERVATION IN AGRO BASED INDUSTRY	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG011	CO-GENERATION AND WASTE HEAT RECOVERY SYSTEMS	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG012	PROTECTED CULTIVATION	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG013	WATERSHED HYDROLOGY AND MANAGEMENT	I, II	a,b,c,d,f,g, i,j,k,l	3	0	0	3
15AG014	RESEVOIR AND FARM POND DESIGN	I, II	a,b,c,d,e,g,k,l	3	0	0	3
15AG015	HARVESTING AND THRESHING MACHINERY	I, II	a,b,c,d,e.i,j,l	3	0	0	3
15AG016	MECHANICS OF TILLAGE AND TRACTION	I, II	a,b,c,d,e.i,j,l	3	0	0	3
15AG017	PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY	I, II	a,b,c,d,e.i,j,l	3	0	0	3
15AG018	HUMAN ENGINEERING AND SAFETY	I, II,III	a,b,c,d,e,g,h, i,j,k ,l	3	0	0	3
15AG019	DISASTER MANAGEMENT	II, III	a,b,d,f,g,h, i,j,k,l	3	0	0	3
15AG020	CDM AND CARBON TRADING TECHNOLOGY	I, II	a,b,c,e,f,g,h, i,j,k ,l	3	0	0	3
15AG021	CLIMATE CHANGE AND ADAPTATION	II, III	a,b,c,e,f,g,h, i,j,k ,l	3	0	0	3
15AG022	AGRICULTURAL MARKETING	II, III	b,d,g,h, i,j,k,l	3	0	0	3
15AG023	PLANT PROTECTION	II,III	a,b,c,e,f,g,h, i,k,l	3	0	0	3
15AG024	EMERGING TECHNOLOGIES IN FOOD PROCESS ENGINEERING	I, II	a,b,c,d,e,f, i,j,k,l	3	0	0	3
15AG025	PRODUCTION TECHNOLOGY OF HORTICULTURAL CROPS LABORATORY	I, II, III	a,b,c,d,e,f,g,i,j ,l	3	0	0	3
15AG026	MUSHROOM PRODUCTION TECHNOLOGY	II,III	a,b,c,e,f,g,h, i,k,l	3	0	0	3
15AG027	AGRIBUSINESS MANAGEMENT AND ENTREPRENEURSHIP	I, II, III	a,b,c,d,e,f,g,i,j ,l	3	0	0	3
15AG028	AGRICULTURAL FINANCE, BANKING AND CO- OPERATION	I, II, III	a,b,c,d,e,f,g,i,j ,l	3	0	0	3
ENTREPRENEURSHIP ELECTIVES							
15GE001	ENTREPRENEURSHIP DEVELOPMENT I	II	b,c,d, e, f & k	3	0	0	3
15GE002	ENTREPRENEURSHIP DEVELOPMENT II	II	b,c, h, i, j & k	3	0	0	3
PHYSICAL SCIENCE ELECTIVES							
15GE0P1	NANOMATERIALS SCIENCE	I,II	a	3	0	0	3
15GE0P2	SEMICONDUCTOR PHYSICS & DEVICES	I,II	a	3	0	0	3
15GE0P3	APPLIED LASER SCIENCE	I,II	a	3	0	0	3
15GE0C1	CORROSION SCIENCE	I,II	a	3	0	0	3
15GE0C2	ENERGY STORING DEVICES AND FUEL CELLS	I,II	a	3	0	0	3
15GE0C3	POLYMER CHEMISTRY AND PROCESSING	I,II	a	3	0	0	3

OPEN ELECTIVES							
15AG0YA	ENTREPRENEURSHIP DEVELOPMENT AND FOOD QUALITY MANAGEMENT IN FOOD INDUSTRY	II, III	b,d,g,h,i,j,k,l,	3	0	0	3
15AG0YB	HUMAN ENGINEERING AND SAFETY IN AGRICULTURE	II,III	a,b,c,d,f,g,h,l	3	0	0	3
15AG0YC	ENERGY MANAGEMENT IN AGRICULTURE	II, III	a,b,c,d,f,g,h,l	3	0	0	3
15AG0YD	FARM MECHANISATION	II, III	a,b,c,d,f,g,h,l	3	0	0	3
ONE CREDIT COURSES							
15AG0XA	OPERATION AND MAINATNCE OF MICRO IRRIGATION	II, III	a,b,c,g,h,i,k,l	1	0	0	1
15AG0XB	CUSTOM HIRING CENTRE	II, III	a,b,c,g,h,i,k,l	1	0	0	1
15AG0XC	AGRO PROCESSING CENTRE	II, III	a,b,f,g,h,i,j,k,l	1	0	0	1
15AG0XD	LANDSCAPE DESIGNING AND ARCHITECTURE	II, III	a,b,c,g,h,i,k,l	1	0	0	1
15AG0XE	TRAINING ON THE MANUFACTURE OF AGRICULTURAL	II, III	a,b,c,g,h,i,k,l	1	0	0	1
15AG0XF	TRAINING ON MAINTENANCE ASPECTS OF TRACTOR/COMBINE HARVESTER/POWER TILLER	II, III	a,b,f,g,h,i,j,k,l	1	0	0	1

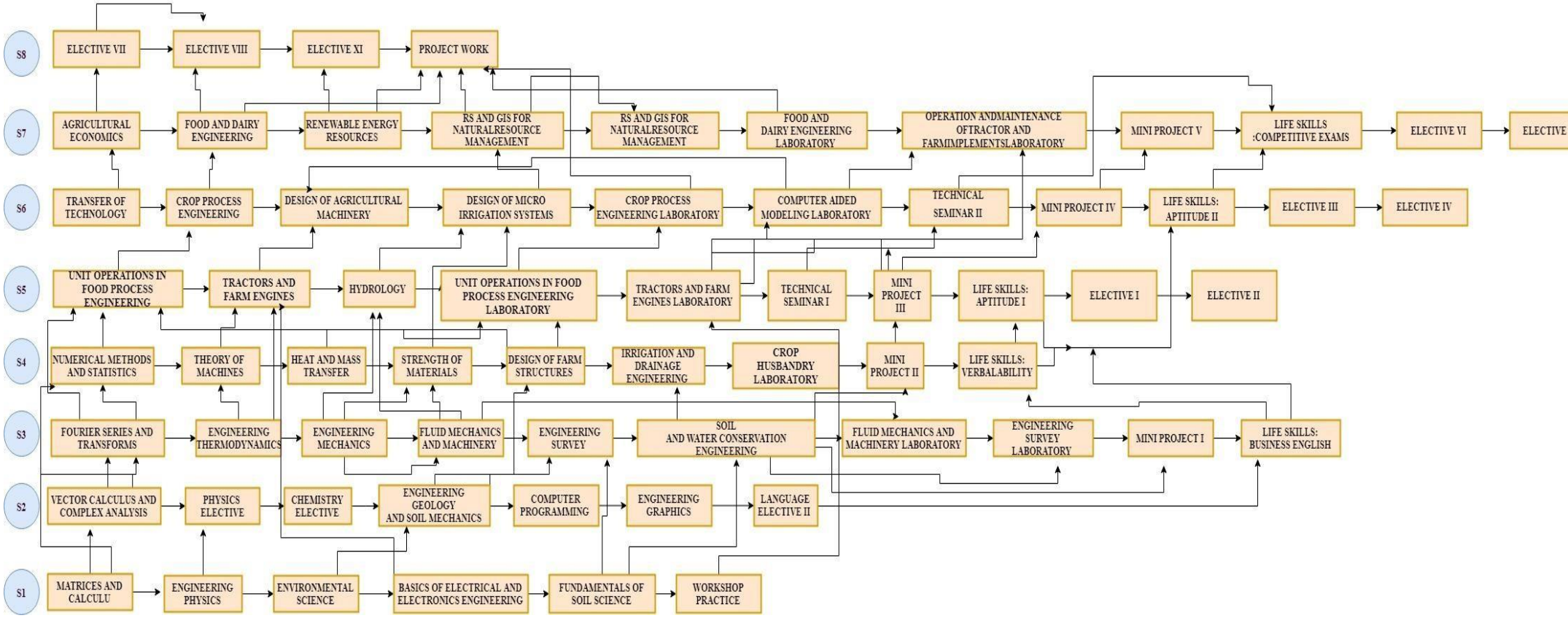
ADDITIONAL ONE CREDIT COURSES (I to III Semesters)					
15GE0XA	HEALTH & FITNESS	-	-	-	1
15GE0XB	FOUNDATION COURSE IN COMMUNITY RADIO TECHNOLOGY	-	-	-	1
15GE0XC	VEDIC MATHEMATICS	-	-	-	1
15GE0XD	INTRODUCTION TO ALGORITHMS	-	-	-	1
15GE0XE	ETYMOLOGY	-	-	-	1
15GE0XF	HINDUSTANI MUSIC	-	-	-	1
15GE0XG	CONCEPT, METHODOLOGY AND APPLICATIONS OF VERMICOMPOSTING	-	-	-	1
15GE0XH	AGRICULTURE FOR ENGINEERS	-	-	-	1
15GE0XI	INTRODUCTION TO DATA ANALYSIS USING SOFTWARE	-	-	-	1
15GE0XJ	ANALYSIS USING PIVOT TABLE	-	-	-	1

VALUE ADDED COURSES		-
15AGV01	ORGANIC FARMING	-
15AGV02	EXTENSION EDUCATION AND TRANSFER OF TECHNOLOGY	-
15AGV03	COCONUT PROCESSING AND VALUE ADDITION	-
BRIDGE COURSES		-
15AGB01	BASIC ENGLISH I	-
15AGB02	VECTOR CALCULUS AND COMPLEX ANALYSIS	-

SUMMARY OF CREDIT DISTRIBUTION

S.No	Category	Credits per semester								Total Credit	Credits in %	Range of Total Credits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	7	12	4	3	-	-	-	-	26	15	15%	20%
2	ES	4	6	16	10	-	-	-	-	36	20	15%	20%
3	HSS	6	3	-	-	-	-	3	-	12	7	5%	10%
4	PC	3	3	3	9	16	13	13	-	60	34	30%	40%
5	PE	-	-	-	-	6	6	6	9	27	15	10%	15%
6	EEC	-	-	1	1	2	2	1	9	16	9	10%	15%
	Total	20	24	24	23	24	21	23	18	177	100	-	-

BS - Basic Sciences
ES - Engineering Sciences
HSS - Humanities and Social Sciences
PC - Professional Core
PE - Professional Elective
EEC - Employability Enhancement Course
CA - Continuous Assessment
ES - End Semester Examination


S8
ELECTIVE VII
ELECTIVE VIII
ELECTIVE XI
PROJECT WORK
S7
AGRICULTURAL ECONOMICS
FOOD AND DAIRY ENGINEERING
RENEWABLE ENERGY RESOURCES
RS AND GIS FOR NATURALRESOURCE MANAGEMENT
RS AND GIS FOR NATURALRESOURCE MANAGEMENT
FOOD AND DAIRY ENGINEERING LABORATORY
OPERATION ANDMAINTENANCE OFTRACTOR AND FARMIMPLEMENTSLABORATORY
MINI PROJECT V
LIFE SKILLS :COMPETITIVE EXAMS
ELECTIVE VI
ELECTIVE
S6
TRANSFER OF TECHNOLOGY
CROP PROCESS ENGINEERING
DESIGN OF AGRICULTURAL MACHINERY
DESIGN OF MICRO IRRIGATION SYSTEMS
CROP PROCESS ENGINEERING LABORATORY
COMPUTER AIDED MODELING LABORATORY
TECHNICAL SEMINAR II
MINI PROJECT IV
LIFE SKILLS: APTITUDE II
ELECTIVE III
ELECTIVE IV
S5
UNIT OPERATIONS IN FOOD PROCESS ENGINEERING
TRACTORS AND FARM ENGINES
HYDROLOGY
UNIT OPERATIONS IN FOOD PROCESS ENGINEERING LABORATORY
TRACTORS AND FARM ENGINES LABORATORY
TECHNICAL SEMINAR I
MINI PROJECT III
LIFE SKILLS: APTITUDE I
ELECTIVE I
ELECTIVE II
S4
NUMERICAL METHODS AND STATISTICS
THEORY OF MACHINES
HEAT AND MASS TRANSFER
STRENGTH OF MATERIALS
DESIGN OF FARM STRUCTURES
IRRIGATION AND DRAINAGE ENGINEERING
CROP HUSBANDRY LABORATORY
MINI PROJECT II
LIFE SKILLS: VERBALABILITY
S3
FOURIER SERIES AND TRANSFORMS
ENGINEERING THERMODYNAMICS
ENGINEERING MECHANICS
FLUID MECHANICS AND MACHINERY
ENGINEERING SURVEY
SOIL AND WATER CONSERVATION ENGINEERING
FLUID MECHANICS AND MACHINERY LABORATORY
ENGINEERING SURVEY LABORATORY
MINI PROJECT I
LIFE SKILLS: BUSINESS ENGLISH
S2
VECTOR CALCULUS AND COMPLEX ANALYSIS
PHYSICS ELECTIVE
CHEMISTRY ELECTIVE
ENGINEERING GEOLOGY AND SOIL MECHANICS
COMPUTER PROGRAMMING
ENGINEERING GRAPHICS
LANGUAGE ELECTIVE II
S1
MATRICES AND CALCULU
ENGINEERING PHYSICS
ENVIRONMENTAL SCIENCE
BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING
FUNDAMENTALS OF SOIL SCIENCE
WORKSHOP PRACTICE

15MA101 MATRICES AND CALCULUS 3 2 0 4

Course Objectives

- Interpret the introductory concepts of Matrices and Calculus, which will enable them to model and analyze physical phenomena involving continuous changes of variables
- Summarize and apply the methodologies involved in solving problems related to fundamental principles of Matrices and Calculus.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

1. Analyze the characteristics of a linear system with eigen values and vectors.
2. Identify and model the real time problem using first order linear differential equations.
3. Apply the suitable techniques and solve the higher order ordinary differential equations.
4. Characterize the functions and get the solutions of the unconstrained maxima and minima
5. Evaluate the functions to get the surface area and volume using multiple integral.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2		1								
2	1	2		1								
3												
4	1	2		1								
5	1	2										

UNIT I **12 Hours**

MATRICES

Eigen Values and Eigen Vectors of a real matrix - Properties of Eigen Values-Stretching of elastic membranes. Cayley - Hamilton Theorem - Quadratic form: Reduction of a quadratic form to a canonical form.

UNIT II **8 Hours**

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Leibnitz's Equations - Modelling and solutions using Newtons law of cooling of bodies - solutions to R-L and R-C electric circuits.

UNIT III **13 Hours**

ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Linear differential equations of second and higher order with constant coefficients. Linear differential equations of higher order with variable coefficients: Cauchys linear differential equation - Method of variation of parameters for second order differential equations.

UNIT IV **12 Hours**

MULTIVARIABLE CALCULUS

Functions of Two Variables and their solutions- Total Differential - Derivative of implicit functions- Jacobians Unconstrained maxima and minima.

UNIT V **11 Hours**

MULTIPLE INTEGRALS

Double integration with constant and variable limits-Region of integration -Change the order of integration - Area as double integral in cartesian coordinates. Triple integral in Cartesian coordinates.

FOR FURTHER READING

Applications of mass spring system in ordinary differential equations of higher order

Total: 86 Hours

Reference(s)

1. C. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd, 2003.
2. Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited,New Delhi 2015.
3. Peter V. O Neil , Advanced Engineering Mathematics, Seventh Edition , Cengage Learning India Private Limited, 2012.
4. B.S. Grewal, Higher Engineering Mathematics, Forty Third Edition, Khanna Publications , New Delhi 2014.
5. Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India, 2014.
6. T.Veerarajan, Engineering mathematics for First Year,Tata McGraw-Hill Publishing company Limited, New Delhi, 2014.

15PH102 ENGINEERING PHYSICS 2 0 2 3

Course Objectives

- Impart knowledge in properties of matter, crystallography and ultrasonics
- Understand the applications of lasers and fiber optics
- Implement the principles of quantum physics in the respective engineering fields

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Analyze the concept of properties of matter and apply the same for practical applications
2. Identify the suitable laser source for fiber optic communication applications
3. Analyze the properties of ultrasonic waves and apply the same for day today applications
4. Classify the different types of crystal structures and analyze their properties
5. Apply the Schrodinger wave equation to illustrate the motion of quantum particles

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2	1	2										
3	2	1										
4												
5	1	1										

UNIT I **8 Hours**

PROPERTIES OF MATTER

Elasticity: elastic and plastic materials - Hooke's law - elastic behavior of a material -stress -strain diagram- factors affecting elasticity. Three moduli of elasticity- Poisson's ratio-torsional pendulum- twisting couple on a cylinder. Young's modulus- uniform bending -non- uniform bending. Viscosity: coefficient of viscosity - streamline and turbulent flow -experimental determination of viscosity of a liquid -Poiseuille's method.

UNIT II **6 Hours**

APPLIED OPTICS

Interference: air wedge- theory- uses- testing of flat surfaces- thickness of a thin wire. Laser: introduction- principle of laser- characteristics of laser- types: CO2 laser -semiconductor laser (homo junction). Fiber optics: principle of light transmission through fiber- expression for acceptance angle and numerical aperture- types of optical fibers (refractive index profile and mode)- fiber optic communication system (block diagram only).

UNIT III **5 Hours**

ULTRASONICS

Ultrasonics: introduction- properties of ultrasonic waves-generation of ultrasonic waves- magnetostriction- piezo electric methods- detection of ultrasonic waves. Determination of velocity of ultrasonic waves (acoustic

grating). Applications of ultrasonic waves: SONAR- measurement of velocity of blood flow -study of movement of internal organs.

UNIT IV **5 Hours**

SOLID STATE PHYSICS

Crystal Physics: lattice -unit cell -crystal systems- Bravais lattices- Miller indices- 'd' spacing in cubic lattice- calculation of number of atoms per unit cell, atomic radius, coordination number and packing density for SC, BCC, FCC and HCP structures- X-ray diffraction: Laue's method - powder crystal method.

UNIT V **6 Hours**

QUANTUM MECHANICS

Quantum Physics: development of quantum theory- de Broglie wavelength -Schrodinger's wave equation- time dependent and time independent wave equations- physical significance. Application: particle in a box (1d)- degenerate and non-degenerate states. Photoelectric effect: quantum theory of light work function- problems.

FOR FURTHER READING

Neutrions - expanding universe

1 **1 Hours**

INTRODUCTION

Exposure to Engineering Physics Laboratory and precautionary measures

2 **2 Hours**

EXPERIMENT 1

Determine the moment of inertia of the disc and calculate the rigidity modulus of a given wire using torsion pendulum (symmetrical masses method).

3 **2 Hours**

EXPERIMENT 2

Find the elevation of the given wooden beam at the midpoint by loading at the ends and hence calculate the Youngs modulus of the material.

4 **2 Hours**

EXPERIMENT 3

Find the depression at the midpoint of the given wooden beam for 50g, 100 g, 150 g, 200 g and 250 g subjected to non-uniform bending and determine the Youngs modulus of the material of the beam.

5 **2 Hours**

EXPERIMENT 4

Determine the coefficient of viscosity of the given liquid by Poiseulles method.

6 **2 Hours**

EXPERIMENT 5

Form the interference fringes from the air wedge setup and calculate the thickness of the given wire.

7 **2 Hours**

EXPERIMENT 6

By applying the principle of diffraction, determine the wavelength of given laser and the average particle size of lycopodium powder using laser source.

8 **2 Hours**

EXPERIMENT 7

Determine the
(i) wavelength of ultrasonics in a liquid medium,
(ii) velocity of ultrasonic waves in the given liquid
(iii) compressibility of the given liquid using ultrasonic interferometer.

Total: 45 Hours

Reference(s)

1. D. S. Mathur, Elements of Properties of Matter, 5th edition, S Chand & Company Ltd., New Delhi, 2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012.
3. Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, Concepts of Modern Physics, 6th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd., 2013.

15CH103 ENVIRONMENTAL SCIENCE 2 0 2 3

Course Objectives

- Realize the interdisciplinary and holistic nature of the environment
- Understand how natural resources and environment affect the quality of life and stimulate the quest for sustainable development
- Recognize the socio-economic, political and ethical issues in environmental science

Programme Outcomes (POs)

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Assess the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources.
2. Analyze the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment from degradation.
3. Identify the existing environmental challenges related to pollution and its management.
4. Select suitable strategies for sustainable management of components of environmental
5. Correlate the impacts of population and human activities on environment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		2	3				3					
2		2		3			3					
3			2			1	3					
4												
5												

UNIT I **6 Hours**

NATURAL RESOURCES

Forest resources: Use - over exploitation - deforestation - case studies. Water resources: Use - over utilization of surface and ground water - conflicts over water. Mineral resources: Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: Effects of modern agriculture - fertilizer-pesticide problems (eutrophication, blue baby syndrome, biomagnification) - water logging - salinity - case studies. Energy resources: renewable(solar, wind, tidal, geothermal and hydroelectric power) - non renewable energy sources

UNIT II **6 Hours**

ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features: forest ecosystem - desert ecosystem - ecological succession. Biodiversity - value of biodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity - field study

UNIT III **6 Hours**

ENVIRONMENTAL POLLUTION

Pollution: Definition - causes - effects - control measures of air pollution - water pollution : (Sewage water treatment by activated sludge and trickling filter process) - marine pollution - thermal pollution - noise pollution. Disaster management: causes - effects - control measures of floods - earthquake - cyclone - landslides

UNIT IV **7 Hours**

SOCIAL ISSUES AND ENVIRONMENT

Sustainable development : Definition - Unsustainable to sustainable development - urban problems related to energy. Environmental ethics - issues and possible solutions - solid waste management - causes - effects - 3R Principles (landfills, incineration, composting). Water conservation - rain water harvesting - watershed management. Climate change - global warming - acid rain - ozone layer depletion. Environment protection act: Air (Prevention and control of pollution) act - wildlife protection act

UNIT V **5 Hours**

HUMAN POPULATION AND ENVIRONMENT

Human population: Population growth - characteristics - variation among nations - population explosion - women and child welfare programmes - value education - HIV / AIDS. Role of information technology in environment and human health - occupational safety and health administration (OSHA)

FOR FURTHER READING

Human rights:E - waste and biomedical waste -Identification of adulterants in food materials

1 **2 Hours**

EXPERIMENT 1

General instructions to students for handling the reagents and safety precautions.

2 **4 Hours**

EXPERIMENT 2

Estimation of dissolved oxygen in a water sample/sewage by Winklers method

3 **4 Hours**

EXPERIMENT 3

Estimation of chloride content in water by argentometric method

4 **4 Hours**

EXPERIMENT 4

Estimation of calcium in lime by complexometric method

5 **4 Hours**

EXPERIMENT 5

Estimation of chromium in leather tannery effluents

6 **4 Hours**

EXPERIMENT 6

Determination of percentage purity of washing soda

7 **4 Hours**

EXPERIMENT 7

Estimation of heavy metals in the given solution by EDTA method

8 **4 Hours**

EXPERIMENT 8

Determination of Prussian blue dye concentration by spectrophotometer

Total: 60 Hours

Reference(s)

1. Anubha Kaushik, C.P. Kaushik, Environmental Science and Engineering , 4th Multi Colour Edtion, New Age International Publishers, New Delhi, 2014
2. A. Ravikrishnan, Environmental Science and Engineering, 5th revised Edition, Sri Krishna Hitech Publishing company (P) Ltd, Chennai, 2010
3. T. G. Jr. Miller, S. Spoolman, New Environmental Science, 14th Edition, Wadsworth Publishing Co, New Delhi, 2014
4. E. Bharucha, Textbook of Environmental studies, second Edition, Universities Press Pvt. Ltd., New Delhi, 2013
5. A. K. De, Environmental Chemistry, 7th Edition , New age international publishers, New Delhi, 2014

15GE105 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

2 0 2 3

Course Objectives

- To understand the basic concepts of electric circuits and magnetic circuits.
- To illustrate the construction and operation of various electrical machines and semiconductor devices.
- To Learn the fundamentals of communication systems.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis: Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

1. Apply the fundamental laws to electric circuits and compute the different alternating quantities.
2. Apply the laws of magnetism for the operation of DC motor.
3. Examine the construction and working principle of different AC machines
4. Analyze the different speed control methods of DC motors and special machines.
5. Analyze the performance characteristics and applications of semiconductor devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2		1								
2	1	2		1								
3												

4	1	2										
5	1	2		1								

UNIT I **7 Hours**

ELECTRIC CIRCUITS

Definition of Voltage, Current, Electromotive force, Resistance, Power & Energy, Ohms law and Kirchoffs Law & its applications - Series and Parallel circuits - Voltage division and Current division techniques - Generation of alternating emf - RMS value, average value, peak factor and form factor- Definition of real, reactive and apparent power

UNIT II **5 Hours**

DC MACHINES

Introduction of magnetic circuits - Law of Electromagnetic induction, Flemings Right & Left hand rule- Types of induced emf - Definition of Self and Mutual Inductance - DC Motor- Contruction - Working Principle- Applications.

UNIT III **6 Hours**

AC MACHINES

Single Phase Transformer - Alternator - Three phase induction motor - Single phase induction motor - Contruction - Working Principle - Applications.

UNIT IV **5 Hours**

ELECTRICAL DRIVES

Speed control of dc shunt motor and series motor - Armature voltage control - Flux control - Construction and operation of DC servo motor - Construction and operation of DC servo motor stepper motor.

UNIT V **7 Hours**

ELECTRON DEVICES AND COMMUNICATION

Characteristics of PN Junction diode and Zener diode - Half wave and Full wave Rectifiers - Bipolar Junction Transistor - Operation of NPN and PNP transistors - Logic gates - Introduction to communication systems.

FOR FURTHER READING

Voltage Regulator - Stepper motor - Energy meter - SMPS, Satellite and Optical communication.

1 **4 Hours**

EXPERIMENT 1

Analyze the VI characteristics of a fixed resistor and a lamp by varying its temperature.

2 **4 Hours**

EXPERIMENT 2

Apply the voltage division and current division techniques for series and parallel connections of lamp loads.

3 **4 Hours**

EXPERIMENT 3

Understand the concept of electromagnetic induction using copper coil.

4 **4 Hours**

EXPERIMENT 4

Understand the construction and working principle of DC machines.

5 **6 Hours**

EXPERIMENT 5

Determine the VI Characteristics of PN Junction diode and plot the input and output wave shapes of a half wave rectifier.

6 **4 Hours**

EXPERIMENT 6

Realize the working of transistor as an electronic switch through experiments.

7 **4 Hours**

EXPERIMENT 7

Lighting applications using logic gates principle.

Total: 60 Hours

Reference(s)

1. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Smarjith Ghosh, Fundamentals of Electrical and Electronics Engineering, Prentice Hall (India) Pvt. Ltd., 2010
3. A. Sudhakar, Shyammohan S Palli, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill, 2010
4. R. S. Sedha, A Textbook of Applied Electronics, S.Chand & Company Ltd, 2013
5. Muthusubramanian & Salivahanan, Basic Electrical and Electronics Engineering and Communication Engineering, Seventh Edition, Tata MCGraw Hill Education Private Limited, 2011

15AG106 FUNDAMENTALS OF SOIL SCIENCE 2 0 2 3

Course Objectives

- To enhance the knowledge on rock cycle and soil formation processes
- To impart knowledge on physical, chemical and biological properties of soil
- To study the relationships between soil, water and plant

Programme Outcomes (POs)

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

Course Outcomes (COs)

1. Classify rocks and minerals and explain the physical, chemical and biological weathering of rocks and soil formation process
2. Analyse the types soil in India and Tamil Nadu to develop soil maps for various locations
3. Explain soil physical properties and compare the properties based on soil and water system
4. Analyse the soil chemical properties to classify the arable and problem soils to develop different reclamation practices
5. Categorize the function of primary and secondary nutrients in plant and soil system and evaluate the soil organic matter through nutrient management practices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1		2							1	
2		1	-	1	-				-			
3		1	-						-			
4		-	-				-					
5		-	-	-				-				

UNIT I **6 Hours**

CLASSIFICATION AND FORMATION OF SOILS

Pedalogical and edaphological concepts- definition of soil, rocks and minerals-composition of earth-Weathering of rocks and minerals - physical, chemical and biological weathering - factors affecting soil formation processes

UNIT II **6 Hours**

PHASE RELATIONSHIP OF SOIL

Soil texture and textural classes - Soil structure and classification - absolute specific gravity - capillary and non-capillary porosity- Weight and Volume relationships- Gradation analysis- Soil consistency- classification of soil particles and their determination- Soil survey methods- Major soil types of India

UNIT III **6 Hours**

PHYSICAL PROPERTIES OF SOIL

Physical properties of soil and their significance - Bulk density, particle density and porosity - Soil colour - significance - causes and measurement- Soil temperature - Soil air - Soil water- Soil water potentials - Soil moisture constants - Movement of soil water - saturated and unsaturated flow - Infiltration, hydraulic conductivity, percolation, permeability and drainage

UNIT IV **6 Hours**

SOIL COLLOIDS

Soil colloids - Properties, types and significance - Layer silicate clays - their genesis and sources of charges - soil pH- Ion exchange - CEC, AEC and Base saturation - Factors influencing Ion exchange - significance. Soil reaction, Buffering capacity and EC

UNIT V **6 Hours**

SOIL FERTILITY

Soil organic matter - Composition - decomposition and mineralization, C : N ratio, Carbon cycle - Fractions of soil organic matter - Humus formation. Soil organisms - Beneficial and harmful effects- saline and alkali soils and their reclamations- significance of macro and micro nutrients, soil and water testing, soil fertility management- important fertilizers-Soil profile

FOR FURTHER READING
Study of soil profile- identification of different soil types- interpretation of soil and water test data- reclamation of problematic soils

1 **3 Hours**

EXPERIMENT 1
Soil sample collection

2 **3 Hours**

EXPERIMENT 2
Visit to soils of different terrains and study of soil profiles

3 **3 Hours**

EXPERIMENT 3
Determination of bulk density, particle density and porosity - cylinder, wax coating and core methods

4 **3 Hours**

EXPERIMENT 4
Soil textural analysis - feel method, International pipette method

5 **3 Hours**

EXPERIMENT 5
Determination of soil colour and temperature

6 **3 Hours**

EXPERIMENT 6
Determination of soil moisture

7 **3 Hours**

EXPERIMENT 7
Determination of Infiltration rate

8 **3 Hours**

EXPERIMENT 8
Determination of hydraulic conductivity

9 **3 Hours**

EXPERIMENT 9
Determination of soil pH and EC

10 **3 Hours**

EXPERIMENT 10
Estimation of soil organic carbon

Total: 60 Hours

Reference(s)

1. Dilip Kumar Das, Introductory Soil Science, 3rd Edition, Kalyani Publishers, Ludhiana, 2013.
2. T.D. Biswas and S.K. Mukherjee, Text Book of Soil Science, 2nd Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001.
3. Indian Society of Soil Science, Fundamentals of Soil Science, ISSS Publication, IARI, New Delhi, 2012.

15GE107 WORKSHOP PRACTICE

0 0 2 1

Course Objectives

- To provide hands on training for fabrication of components using carpentry, sheet metal and welding equipment / tools.
- To gain the skills for making fitting joints and household pipe line connections using suitable tools.
- To develop the skills for preparing the green sand mould and to make simple household electrical connection
- To provide hands on training for dismantling and assembling of petrol engines, gear box and pumps.
- To develop the skills for making wood/sheet metal models using suitable tools

Programme Outcomes (POs)

a.Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Fabricate simple components using carpentry, sheet metal and welding equipment/tools
2. Make fitting joints and household pipe line connections using suitable tools.
3. Prepare green sand mould and make simple household electrical connections using suitable tools
4. Dismantle and assemble petrol engines, gear box and pumps.
5. Make simple models using wood and sheet metal.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2		3	1								
2			2		3							
3			2	1	3							
4	1		2		3							
5		1	2									

1 **1 Hours**

EXPERIMENT 1

Forming of simple object in sheet metal using suitable tools (Example: Dust Pan / Soap Box)

2 **2 Hours**

EXPERIMENT 2

Fabrication of a simple component using thin and thick plates. (Example: Book rack)

3 **1 Hours**

EXPERIMENT 3

Making a simple component using carpentry power tools. (Example: Pen stand/Tool box/ Letter box].

4 **1 Hours**

EXPERIMENT 4

Prepare a "V" (or) Half round (or) Square joint from the given mild Steel flat.

5 **2 Hours**

EXPERIMENT 5

Construct a household pipe line connections using pipes, Tee joint, Four way joint, elbow, union, bend, Gate way and Taps (or) Construct a pipe connections of house application centrifugal pump using pipes, bend, gate valve, flanges and foot valve.

6 **2 Hours**

EXPERIMENT 6

Prepare a green sand mould using solid pattern/split pattern.

7 **2 Hours**

EXPERIMENT 7

Construct a domestic electrical wire connections using indicator, one way switch with calling bell, two way switch with lamp, one way switch with fan regulator and one way switch with socket.

8 **2 Hours**

EXPERIMENT 8

Dismantling and assembly of Centrifugal Monoblock / Gear Pump / Gear box.

9 **1 Hours**

EXPERIMENT 9

Dismantling and assembly of two stroke and four stroke petrol engine.

10 **1 Hours**

EXPERIMENT 10

Mini Project(Fabrication of Small Components).

Total: 15 Hours

3 2 0 4

15MA201 VECTOR CALCULUS AND COMPLEX ANALYSIS

Course Objectives

- Implement the Complex Analysis, an elegant method in the study of heat flow, fluid dynamics and electrostatics.
- Summarize and apply the methodologies involved in solving problems related to fundamental principles of Calculus viz: Differentiation, Integration and Vectors.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Determine & apply the important quantities associated with vector fields such as the divergence, curl and scalar potential.
2. Apply the theoretical aspects of vector integral calculus in their core areas.
3. Explain the differentiation properties of vectors.
4. Identify the complex functions and their mapping in certain complex planes.
5. Use the concepts of integration to complex functions in certain regions.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1												
2												
3												
4	1	2										
5												

UNIT I **13 Hours**

VECTOR CALCULUS

Gradient -Divergence -Curl - Directional derivative- Solenoidal -Irrotational vector fields -Line Integral - Surface integrals.

UNIT II **12 Hours**

INTEGRAL THEOREMS OF VECTOR CALCULUS

Green's theorem in a plane- Stoke's Theorem- Gauss divergence theorem- Applications involving cubes and parallelepiped.

UNIT III **11 Hours**

ANALYTIC FUNCTIONS

Analytic Functions- Necessary and Sufficient conditions of Analytic Function- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method -Applications to the problems of Potential Flow.

UNIT IV **11 Hours**

MAPPING OF COMPLEX FUNCTIONS

Physical interpretation of mapping- Application of transformation: translation, rotation, magnification and inversion of multi valued functions - Linear fractional Transformation (Bilinear transformation).

UNIT V **13 Hours**

INTEGRATION OF COMPLEX FUNCTIONS

Cauchy's Fundamental Theorem - Cauchy's Integral Formula - Taylor's and Laurent's series- Classification of Singularities - Cauchy's Residue Theorem.

FOR FURTHER READING

Applications to Electrostatic and Fluid Flow.

Total: 90 Hours

Reference(s)

1. C. Ray Wylie and C. Louis Barrett, Advanced Engineering Mathematics, Tata McGraw-HillPublishing Company Ltd, 2003
2. Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited,New Delhi 2015
3. J. A. Brown and R. V. Churchill, Complex Variables and Applications , Sixth Edition, McGraw Hill,New Delhi, 1996

4. B. S. Grewal, Higher Engineering Mathematics, Forty third Edition, Khanna Publications , New Delhi 2014
5. Peter V. O. Neil, Advanced Engineering Mathematics, Seventh Edition ,Cengage Learning India Private Limited, 2012
6. Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India,2007

15AG205 ENGINEERING GEOLOGY AND SOIL MECHANICS

2 0 2 3

Course Objectives

- To acquire the knowledge on engineering geology and basic geomorphic processes
- To impart knowledge on applied geomorphology and hydrogeology
- To gain knowledge on soil mechanics and the procedures to test the soil interns of dam and reservoir construction

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture.

Course Outcomes (COs)

1. Understand the basic geomorphic processes
2. Apply suitable technique/procedure in dam and reservoir construction
3. Assess the concepts of hydraulics soil process of through
4. Realize the concepts of soil of water relationship students will be able to
5. Analyze the fundamental concepts of soil strength

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	3	-				-				
2	2	1	3	2	2	-	1					
3	1	3	1	2		-	1					
4	1	3	2	1	-		1					
5	1	3	1	2		-	-				-	

UNIT I **8 Hours**

GEOLOGY AND APPLIED GEOLOGY

Introduction to Geology and Engineering Geology - importance - Earth's layers -Geological structures - Geomorphology - Concepts - Processes and Forms - Fluvial and Eolian Geomorphology-Drainage analysis-Watershed characteristics - Channel Geomorphology-Drainage pattern - Hydrogeology- Hydrological cycle - Water table-Aquifer - Groundwater flow - Well hydraulics - water quality

UNIT II **6 Hours**

SITE INVESTIGATION AND CONSTRUCTION

Hydrogeological Investigations - surface and sub surface - Approach - Content -Cost - Desk study - Field reconnaissance - Field investigations - Construction records - Reservoirs construction-Dams and Dam Sites - Parambikulam -Aliyar Project - Geology of Tamil Nadu - Remote Sensing and GIS applications in Water Resources Project Monitoring.

UNIT III **6 Hours**

FLOW HYDRAULICS THROUGH SOIL

Permeability - Darcy's law-discharge velocity Ã¢?? validity of DarcyÃ¢??s law- seepage velocity - Factors affecting permeability - Hydraulics of laminar flow through soils-Seepage - Drainage Ã¢?? Properties of Flow net - Determination of specific gravity - soil consistency - Atterberg limits Ã¢?? liquid limit, plastic limit and shrinkage limit Ã¢?? relative density of cohesion less soil

UNIT IV **4 Hours**

COMPACTION AND CONSOLIDATION

Compaction - objectives -relationship with water content- the Standard Proctor compaction test - factors affecting compaction-methods of compaction in field - Compressibility -coefficient of Compressibility - Consolidation of soils -stages of consolidation.

UNIT V **6 Hours**

STRENGTH OF SOILS

Shear strength concept of shearing resistance and shearing strength - Coulomb's law - Mohr's circle of stresses - Earth pressure at rest - active pressure - passive pressure - Bearing capacity of soils- method of improving the bearing capacity of soils

FOR FURTHER READING

Geology of sedimentary basins in Tamil Nadu-Case study-consolidation of soil-ground improvement

1 **3 Hours**

EXPERIMENT 1

Determination of field density by core cutter method and sand replacement method

2 **3 Hours**

EXPERIMENT 2

Mechanical analysis of soil sieving

3 **3 Hours**

EXPERIMENT 3

Hydrometer analysis for grain size distribution

4 **3 Hours**

EXPERIMENT 4

Determination of Atterberg limits of soil consistency

5 **3 Hours**

EXPERIMENT 5

Determination of hydraulic conductivity by constant permeameter and variable head permeameter

6 **3 Hours**

EXPERIMENT 6

Proctor compaction test of soils

7 **3 Hours**

EXPERIMENT 7

Consolidation test of soils

8 **3 Hours**

EXPERIMENT 8

Direct shear test of soil

9 **3 Hours**

EXPERIMENT 9

Problems on Bearing Capacity, Permeability, Compaction and Compressibility

10 **3 Hours**

EXPERIMENT 10

Field visit Landslides areas and control measures

Total: 60 Hours

Reference(s)

1. A.Parthasarathy, V.Panchapakesan and R.Nagarajan, A textbook of Engineering Geology, Wiley publication, 2013.
2. F.G.Bell, A text book of Engineering Geology, Second Edition, Elsevier, 2007.
3. F.G.H Blyth and M.H Freitas, A textbook of Geology for Engineers, 7th Edition, Elsevier Publication, 2006.
4. B.C.Punmia, Soil Mechanics and Foundation, Laxmi publishers, New Delhi,2004.
5. S.K. Garg, Soil mechanics, Khanna publishers, New Delhi, 2005.
6. V.N.S. Murthy, A textbook of Soil Mechanics and Foundation Engineering, Sri Kripa Technical Consultants, Bangalore, 2008.

3 0 2 4

15GE206 COMPUTER PROGRAMMING

Course Objectives

- To learn the basics of computer organisation.
- To study the basics of C primitives, operators and expressions.
- To understand the different primitive and user defined data types.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Develop solutions using problem solving techniques and number system conversions
2. Develop programs using operators, type conversion and input-output functions
3. Apply decision making and looping statements in writing C programs
4. Apply the concepts of arrays and strings in developing C programs
5. Design applications using structures and functions in C

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3			3							
2	2	3			3							
3	2	3			3							
4	1	3			3							
5	1	3			3							

UNIT I **8 Hours**

INTRODUCTION TO COMPUTERS

Introduction to computers - Characteristics of Computers - Evolution of Computers - Computer Generations - Basic Computer Organization - Number System - Problem Solving Techniques - Features of a Good Programming Language.

UNIT II **9 Hours**

INTRODUCTION TO C PROGRAMMING

Overview of C-Structure of C program-Keywords-Constants- Variables-Data types-Type conversion Operators and Expressions: Arithmetic-Relational-Logical-Assignment- Increment and Decrement-Conditional-Bitwise - Precedence of operators-Managing I/O operations-Formatted I/O-Unformatted I/O.

UNIT III **10 Hours**

CONTROL STATEMENTS

Decision Making and Branching: simple if statement-if else statement-nesting of if else Statement-Switch Statement. Decision Making and Looping: while statement-do while statement-for statement-Nested for statement Jump Statements: goto-break-continue-return statement

UNIT IV **9 Hours**

ARRAYS AND STRINGS

Arrays: Introduction, one dimensional array, declaration - Initialization of one dimensional array, two-dimensional arrays, initializing two dimensional arrays, multi dimensional arrays.
Strings: Declaring and initializing string variables- Reading strings from terminal - writing string to screen - String handling functions.

UNIT V **9 Hours**

STRUCTURES AND FUNCTIONS

Structures and Unions: Introduction-defining a structure- declaring structure variables-accessing structure members- structure initialization-Unions-Enumerated data type
User Defined Functions: Elements of user defined functions -Definition of functions-return values and their types- function calls-function declaration-categories of function -call by value and call by reference-recursion-Preprocessor directives and macros.

FOR FURTHER READING

Creating and manipulating document using word - Mail merge - Creating spread sheet with charts and formula using excel - developing power point presentation with Animations - C graphics using built in functions

1 **1 Hours**

EXPERIMENT 1

Write a C program to perform arithmetic operations on integers and floating point numbers.

2 **1 Hours**

EXPERIMENT 2

Write a C program to implement ternary operator and relational operators.

3 **1 Hours**

EXPERIMENT 3

Write a C program to find the greatest of three numbers using if-else statement.

4 **2 Hours**

EXPERIMENT 4

Write a C program to display the roots of a quadratic equation with their types using switch case.

5 **2 Hours**

EXPERIMENT 5

Write a C program to generate pyramid of numbers using for loop.

6 **3 Hours**

EXPERIMENT 6

Write a C program to perform Matrix Multiplication

7 **2 Hours**

EXPERIMENT 7

Write a C program to check whether the given string is Palindrome or not.

8 **2 Hours**

EXPERIMENT 8

Write a C program to find the factorial of given number.

9 **2 Hours**

EXPERIMENT 9

Design a structure to hold the following details of a student. Read the details of a student and display them in the following format Student

Total: 61 Hours

Reference(s)

1. Pradeep K. Sinha, Priti Sinha, Computer Fundamentals, BPB publications, 2008
2. Ashok. N. Kamthane, Computer Programming, Second Edition, Pearson Education, 2012
3. E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2012

4. Herbert Schildt, C -The complete Reference, Tata McGraw-Hill, 2013
5. Byron Gottfried, Programming with C, Schaum's Outlines, Tata Mcgraw-Hill, 2013

15GE207 ENGINEERING GRAPHICS 0 0 4 2

Course Objectives

- To learn conventions and use of drawing tools in making engineering drawings.
- To draw orthographic projections of points, line and solids.
- To draw the section of solids and development of surfaces of the given objects.
- To draw the isometric projections and perspective projections of the given solids.
- To introduce CAD software to draw simple two dimensional drawings.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1. Recognize the conventions and apply dimensioning concepts while drafting simple objects.
2. Draw the orthographic projection of points, line, and solids.
3. Draw the section of solid drawings and development of surfaces of the given objects.
4. Draw the isometric and perspective projection of the given objects.
5. Draw the simple two dimensional drawings using computer aided drawing tool.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1					1		1		2		1
2	2					2		2		2		1
3	2					2		2		3		1
4	2					3		3				2
5												

UNIT I **6 Hours**

CONVENTIONS AND BASIC DRAWINGS

Importance - conventions - ISO and BIS - drawing tools and drawing sheets - lettering, numbering, dimensioning, lines and Symbols-Conic sections - types constructions -ellipse, parabola and hyperbola - eccentricity and parallelogram method.

UNIT II **6 Hours**

ORTHOGRAPHIC PROJECTIONS

Principles - first and third angle projections - Points - first angle projection of points, straight lines - parallel, perpendicular and inclined to one reference plane, solid - cylinders, pyramids, prisms and cones.

UNIT III **6 Hours**

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACE

Section of solids - simple illustrations. Development of surfaces - cylinders, pyramids, prisms, cones and simple truncated objects.

UNIT IV **6 Hours**

ISOMETRIC AND PERSPECTIVE PROJECTIONS

Importance - orthographic to isometric projection - simple and truncated solids- perspective projections of simple solids.

UNIT V **6 Hours**

INTRODUCTION TO COMPUTER AIDED DRAWING (NOT FOR END SEMESTER EXAMINATION)

Basics commands of AutoCAD - two dimensional drawing, editing, layering and dimensioning - coordinate Systems -Drawing practice - orthographic views of simple solids using AutoCAD.

Total: 30 Hours

REFERENCE(S)

1. K Venugpoal, Engineering Drawing and Graphics, Third edition, New Age International, 2005.
2. Basant Agrawal, Mechanical drawing, Tata McGraw-Hill Education, 2008.
3. Engineering Drawing Practice for Schools & Colleges, BUREAU OF INDIAN STANDARDS-SP46, 2008.
4. N. D. Bhatt and V. M. Panchal, Engineering Drawing, Charotar Publishing House Pvt. Limited, 2008.
5. K.V.Natarajan, A Text Book of Engineering Graphics, Dhanalakshmi Publishers, 2013.
6. George Omura, Brian C. Benton, Mastering AutoCAD 2015 and AutoCAD LT 2015: Autodesk Official Press, Wiley Publisher, 2015.

15MA301 FOURIER SERIES AND TRANSFORMS 3 2 0 4

Course Objectives

- Understand the concepts of Fourier series, Transforms and Boundary Conditions, which will enable them to model and analyze the physical phenomena
- Implement the Fourier analysis, an elegant method in the study of heat flow, fluid mechanics and electromagnetic fields.
- Summarize and apply the mathematical aspects that contribute to the solution of one dimensional wave equation
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Course Outcomes (COs)

1. Identify the periodicity of a function and formulate the same as a combination of sine and cosine using Fourier series.
2. Formulate a function in frequency domain whenever the function is defined in time domain.
3. Apply the Fourier transform, which converts the time function into a sum of sine waves of different frequencies, each of which represents a frequency component.
4. Classify a partial differential equation and able to solve them.
5. Use the Z-transform to convert a discrete-time signal, which is a sequence of real or complex numbers, into a complex frequency domain representation.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	-										
2	1	2	-	-								
3	1	-			-							
4	1	3	-									
5	1							-				

UNIT I **12 Hours**

FOURIER SERIES

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range cosine and sine series - Root mean square value.

UNIT II **12 Hours**

LAPLACE TRANSFORM

Laplace Transform- Existence Condition -Transforms of Standard Functions - Unit step function, Unit impulse function- Properties- Transforms of Derivatives and Integrals - Initial and Final Value Theorems - Laplace transform of Periodic Functions - Inverse Laplace transforms.

UNIT III **11 Hours**

FOURIER TRANSFORM

Fourier Integral Theorem- Fourier Transform and Inverse Fourier Transform- Sine and Cosine Transforms - Properties - Transforms of Simple Functions - Convolution Theorem - Parseval's Identity

UNIT IV **11 Hours**

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of Second Order Quasi Linear Partial Differential Equations - Fourier Series Solutions of One Dimensional Wave Equation - One Dimensional Heat Equation - Steady State Solution of Two-Dimensional Heat Equation - Fourier Series Solutions in Cartesian Coordinates.

UNIT V **12 Hours**

Z -TRANSFORM

Z-Transform - Elementary Properties - Inverse Z-Transform - Convolution Method- Partial fraction method - Solution of Difference Equations using Z-Transform.

FOR FURTHER READING

Solutions of one dimensional wave equation and heat equations using Laplace transforms method.

Total: 88 Hours

Reference(s)

1. Larry.C.Andrews and Bhimsen.K.Shivamoggi, Integral Transforms for Engineers, First Edition, PHI Learning, New Delhi, 2007
2. Ian.N.Sneddan, The Use of Integral Transforms, Second Edition, McGraw Hill companies, 1972.
3. E. Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, Inc, Singapore, 2008.
4. Peter V. O. Neil,Advanced Engineering Mathematics, Seventh Edition, Cenage Learning India Private Ltd, 2012.
5. B.S. Grewal, Higher Engineering Mathematics, Fortieth Edition, Khanna Publications, New Delhi 2007.
6. C. Ray Wylie and C. Louis Barrett,Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd, 2003.

15AG302 ENGINEERING THERMODYNAMICS 3 2 0 4

Course Objectives

- To acquire knowledge about the fundamentals of thermodynamic laws, concepts, principles and mechanism in accounting for the macroscopic physical systems.
- To understand the concepts and working of heat pumps and refrigerator.
- To apply the thermodynamic concepts in various applications like Air standard cycles.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

1. Apply the first law of thermodynamics to closed and open systems
2. Solve the problems related to cycles and cyclic devices using second law of thermodynamics
3. Determine the thermodynamic properties of pure substances and its phase change processes
4. Determine the thermodynamic properties of gas mixtures and analyze their relationships
5. Evaluate the air standard performance of heat engines and properties of psychrometry

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1									
2	2	3	1									
3	3	2	2	1								
4	3	2	1									
5	3	2	1									

UNIT I **9 Hours**

CONCEPTS AND FIRST LAW OF THERMODYNAMICS

Basic Concepts - concept of continuum, Macroscopic approach. Thermodynamic systems - Closed, Open. Control volume. Thermodynamic properties and equilibrium state of a system. Path and process. Quasi Static process. Modes of work. Zeroth law of thermodynamics. Concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics - Applied to closed and open systems-isolated systems. Internal energy. Specific heat at constant volume (Cv) and Specific heat at constant pressure (Cp). Enthalpy-Limitations of Laws of thermodynamics.

UNIT II **9 Hours**

SECOND LAW OF THERMODYNAMICS

Second law of thermodynamics - Kelvin Planck and Clausius statements. Reversibility and Irreversibility. Clausius inequality. Entropy concept-a point function or a property of a system- efficiency, Principle of increase of entropy - Change of entropy during thermodynamic processes. Carnot theorem- absolute entropy-availability. Coefficient of Performance of heat pumps and refrigerator.

UNIT III **9 Hours**

PROPERTIES OF PURE SUBSTANCES

Thermodynamic properties of pure substances in solid, liquid and vapour phases, Pressure-Volume (P-V), Pressure - Temperature (P-T), Temperature - Volume (T-V), Temperature - Entropy (T-S), Enthalpy - Entropy (H-S), Pressure-Volume-Temperature (P-V-T) diagrams. Thermodynamic properties of steam - Calculations of work done and heat transfer in non flow and flow process.

UNIT IV **9 Hours**

PROPERTIES OF GASES, THERMODYNAMIC RELATIONS

Properties of ideal and real gases. Equation of state. Avagadro's law. Vander Waal's equation of states. Dalton's law of partial pressure. Properties of mixture of Gases. Maxwell relations. Temperature-Change in entropy (T-dS) equation. Clausius-Clayperon equations. Joule Thomson Coefficient. Amagat's Law. Gibbs Function.

UNIT V **9 Hours**

AIR STANDARD CYCLES AND PSYCHROMETRY

Air standard cycles - Otto, Diesel and Dual, Calculation of mean effective pressure and Air standard efficiency. Rankine cycle and Brayton cycle efficiencies-Concepts of Stirling and Ericsson cycles. Psychometric properties and processes - Psychrometric chart.

FOR FURTHER READING

Perpetual motion machine of the first kind, Third law of Thermodynamics and Postulatory Thermodynamics, Measurements of steam quality

Total: 75 Hours

Reference(s)

1. Y. Cengel and Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2003.
2. Rayner Joel, Basic Engineering Thermodynamics, Pearson Publications, 2012.
3. S. Khurmi, text book of thermodynamics and Heat transfer, S. Chand Publications, New Delhi, 2002.
4. C. P. Arora, Thermodynamics, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2003,
5. R. S. Khurmi, Steam table with Psychometric chart, S. Chand Publications, New Delhi, 2002.
6. Merle C. Potter, Craig W. Somerton, Thermodynamics for Engineers, Schaum Outline Series, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2004.

15AG303 ENGINEERING MECHANICS 3 2 0 4

Course Objectives

- To acquire a fundamental understanding of static equilibrium concepts of a particle and rigid bodies by applying Newtons law of motion to solve engineering problems.
- To apply free body diagram representation for analyzing simple structures such as statically determinate beams subjected to various loading and support.
- To acquire the knowledge on basics of friction, centroid, moment of inertia, mass moment of inertia for a plane areas and composite areas.
- To learn about simple dynamic variables to solve simple dynamic problems involving kinematics, energy and momentum.
- TO apply the concepts of rigid body kinetics to solve engineering problems

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
k. Project Management and Finance :Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. problems pertaining to agriculture

Course Outcomes (COs)

1. Apply conceptual knowledge to solve problems dealing with particles and rigid body mechanics.
2. Construct free-body diagrams and to calculate the reactions necessary to ensure static equilibrium
3. Calculate centroid, moments of inertia and mass moment of inertia of plane and composite areas.
4. Determine the dynamic equilibrium equation for simple problems.
5. TO apply the concepts of rigid body kinetics to solve engineering problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1					3				2	
2	1	1	-								2	
3	2	1									2	
4	2	1	-								2	
5	2	1			-						2	

UNIT I **10 Hours**

BASIC CONCEPTS AND STATICS OF PARTICLES

Introduction to Mechanics - Idealization of Mechanics, Laws of mechanics (Fundamental Principle). Principle of Transmissibility. Vector - Addition, Subtraction, and Product. Force- Types of Force, System of Forces, Resultant of Forces, Composition of forces. Resolution of force- Sine rule, Cosine rule, Parallelogram law, Triangle law, Polygon Law. Simple Problems. Resultant of Several Concurrent Forces- Rectangular component of force. Equilibrium - Types of Equilibrium, Equilibrant, Condition for Equilibrium of a particle, Types of Support, Free Body Diagram, Equilibrium of two force body, Equilibrium of three force body, Lami's Theorem. Forces in space - Rectangular component of force in a space, Equilibrium of a particle in space.

UNIT II **9 Hours**

STATICS OF RIGID BODIES

Moment of a Force about the point - Varignon's Theorem. Moment of a couple. Resolution of a given force into a force acting at a given point and a couple. Resultant of- Coplanar parallel force system, Coplanar concurrent force system, Coplanar Non parallel non-concurrent system. Equilibrium of Rigid Bodies in 2D. Types of Support and their reactions (2D) - Beams. Types of Loads. Equilibrium of Rigid bodies in three dimensions.

UNIT III **10 Hours**

PROPERTIES OF SURFACES AND SOLIDS

Basic Definitions - Gravity Axis of body, Centre of gravity, Centre of mass, Centroid. Determination of Centre of Gravity, Centre of Mass and Centroid of Lines Areas and Volumes. Procedure to find Centroid of Composite areas and Lines. Theorems of Pappus and Guldinus. Centroid of Volumes and Bodies- Second Moment of Area, Perpendicular axis Theorem, Parallel Axis theorem, M.I of some plane areas. Polar moment of inertia -Mass moment of inertia (Basics only)

UNIT IV **8 Hours**

FRICTION

Introduction - Types of friction, Characteristics of Dry Friction, Laws of Friction, Angle of friction, Angle of Repose. Cone of friction - Body on Horizontal Plane and Inclined plane, Two bodies in contact, Ladder Friction, Wedge Friction, Screw Friction, Rolling Resistance.

UNIT V **8 Hours**

DYNAMICS OF PARTICLES

Displacements, Velocity and acceleration-their relationship. Linear motion - Curvilinear motion (no derivations). Newton's law - Work Energy Equation of particles. Law of conservation of energy and momentum- Principle of Impulse and Momentum - Impact of elastic bodies.

FOR FURTHER READING

Truss -Analysis of truss by Method of Pin Joints, Analysis of truss by Method of sections. Frames-internal force of a member. Friction in bearing. Equilibrium of rigid bodies (Ball and socket joint).

Total: 75 Hours

Text Book(s)

1. F.P. Beer and Jr. E.R Johnston, Vector Mechanics for Engineers - Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2007.

Reference(s)

1. N.H.Dubey, Engineering Mechanics- Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2013
2. Velamurali, Engineering Mechanics , Oxford University Press, New Delhi, 2013.
3. R.C.Hibbeller, Engineering Mechanics: Combined Statics & Dynamics, New Jersey: Prentice Hall, 2013.
4. S. Rajasekaran and G. Sankarasubramanian, Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt Ltd, New Delhi, 2005.
5. I.B.Prasad, Text Book of Applied Mechanics, Khanna Publs, New Delhi-6.

15AG304 FLUID MECHANICS AND MACHINERY 3 0 0 3

Course Objectives

- To study the different properties of fluids
- To analyze pattern and nature of the flow of fluids in pipes and open channel
- To gain an understanding of flow measurements and hydraulic machines

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Explain the fundamental properties of fluids and measures of pressure in fluid statics
2. Classify the fluid flow and its pattern
3. Measure the rate of flow of fluids using flow measuring devices
4. Design the most economical channel section and measure the flow in channels
5. Assess the performance of pumps based on characteristic curves

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2										
2	3	2										
3	3	2	1									
4	2	3	1		2							
5	2	3	1		2							

UNIT I **9 Hours**

PROPERTIES OF FLUIDS

Properties of fluids- definition -units of measurement - Measurement of pressure by various types of manometers - Hydrostatic forces on surfaces -total pressure and center of pressure - Horizontal- vertical and inclined plane surface - Archimedes principles - buoyancy - metacenter - metacentric height

UNIT II **9 Hours**

FLUID FLOW ANALYSIS

Types of fluid flow - velocity and acceleration of a fluid particle - Flow pattern-velocity potential- stream function. Principles of conservation of mass -energy-momentum - continuity equation in Cartesian co-ordinates.

UNIT III **9 Hours**

FLOW MEASUREMENTS

Euler's equation of motion - Bernoulli's equation - applications - Venturimeter - orifice meter, Rotometer - Pitot tube- Flow through pipes - laminar and turbulent flow in pipes -- Darcy - Weisbach equation for friction head loss - Chezy's formula - Major and minor losses in pipes.

UNIT IV **9 Hours**

OPEN CHANNEL FLOW

Types of flow in channel - Most economical section of channel - rectangular -trapezoidal. Specific energy and critical depth - Specific force - critical flow - computation. Flow measurement in channels - notches - rectangular, triangular.

UNIT V **9 Hours**

DIMENSIONAL ANALYSIS

Dimensional analysis -concept of geometric, kinematic and dynamic similarity. Important non dimensional numbers -Centrifugal pumps - components- working - specific speed ---characteristics curves. Submersible pumps - Jet pump- reciprocating pump.

FOR FURTHER READINGS

Newtonian and Non Newtonian fluids- Stream line, Streak line, Path line, Time line - Application of Bernoulli's Equation - Pipes in series - Equivalent pipe - Model and Prototype - Similitude

Total: 45 Hours

Reference(s)

1. Yunus A. Cengel, John M. Cimbala, Fluid Mechanics-Fundamentals and Applications, Tata McGraw Hill Publishing Co, New Delhi, 2006.
2. R.K. Bansal, A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi publications (P) Ltd, New Delhi, 2002.
3. K. Subramanya, Flow in Open Channels, Tata McGraw Hill Publishing Co, New Delhi, 2009.
4. P.N. Modi and S.M. Seth, Hydraulics and fluid mechanics, Standard Publishers & Distributors, New Delhi.
5. RJ. Grade, Fluid mechanics through problems, Wiley eastern Ltd, Chennai, 2002.
6. Jagadish Lal, Hydraulic machines, Metropolitan book house, New Delhi, 2000.

15AG305 ENGINEERING SURVEY 3 0 0 3

Course Objectives

- To understand the principle, concepts and methods of surveying
- To learn and practice different types of surveying methods like chain surveying, compass surveying, etc.
- To learn and practice leveling and contouring

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

Course Outcomes (COs)

1. Identify the instruments required for conducting the chain survey in level and sloping ground
2. Determine the area of the land by chain surveying and also can apply the necessary chain corrections
3. Compute the area and volume of earth work by simple and numerical methods
4. Identify the angle between the stations by prismatic compass and conduct the plane table surveying for locating the new stations
5. Find the Reduced level for all points by using dumpy level, prepare the contour map and also identify the horizontal, vertical angle using Theodolite

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	3									
2	2	-	2	3						2		
3	1	-	2	3				-		2		
4	1	-	-			2	3				1	
5	1	-	-									

UNIT I **9 Hours**

PRINCIPLES OF SURVEYING

Introduction - Principles and basic concepts and uses of surveying - classification and basic methods of surveying- Types of chains, Ranging rod, Ranging - Direct and Indirect methods -Method of Chaining on level and sloping ground - Obstacles in chaining.

UNIT II **9 Hours**

CHAIN SURVEYING

Introduction - Principles of chain surveying - selection of survey stations and lines - Offsets - types, Measurement - cross staff and optical square - Steps involved in Chain Survey - Reconnaissance, Index sketch, Reference sketch, Booking entries in field book - Plan and Map, Scale - Plain and Diagonal - Testing of Chain, Degree of accuracy in chaining, Errors and compensation - cumulative, mistakes - Determination of limiting length of offset and problems.

UNIT III **9 Hours**

COMPUTATION OF AREA AND VOLUME

Introduction - Formulae for calculation of cross sectional area -calculation of volume - Area computation, Mid-Ordinate rule, Average ordinate rule, Trapezoidal rules, Simpson rule and Coordinate method of finding area-Computation of volume.

UNIT IV **9 Hours**

COMPASS TRAVERSING

Basic terminologies of Compass traversing - Prismatic and Surveyors Compass - Checking the accuracy of traverse - Errors and mistakes in Compass survey - Plane tabling - instruments and accessories - Radiation, Traversing, Orientation - Intersection and Resection.

UNIT V **9 Hours**

LEVELLING AND CONTOURING

Levelling - definition - Benchmarks - different types of levels - Basic principles of leveling - Theory of simple, compound, cross sectional and reciprocal levelling -Contouring - definition - contour characteristics - direct and indirect methods -gradient contour - uses - Minor instruments, Hand level - Clinometer - Abney level- Theodolite types - adjustments - setting up - reading angles - measurements - Area and elevation determination.

FOR FURTHER READING

Merits and demerits of plane table surveying - Description and uses of theodolite - Omitted measurements - Radial contouring - Modern Trends in surveying and advance equipments.

Total: 45 Hours

Reference(s)

1. Punmia. B.C "Surveying (Vol- I & Vol-II)" Laxmi publications, New Delhi. 1991.
2. Kanetkar, T.P. & Kulkarni, S.V., "Surveying & leveling". Part I, A.V.G. Prakashan, Poona. 1984.
3. Basak. V.N, "Surveying and Levelling", Tata McGraw hill publications, New Delhi. 1994.

15AG306 SOIL AND WATER CONSERVATION ENGINEERING

2 2 0 3

Course Objectives

- To acquire the fundamental understanding of soil conservation practices and erosion control structures
- To develop skills on water conservation and harvesting
- To provide knowledge on watershed development and management

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Identify the causes of soil erosion, types of soil erosion and assess the total soil loss for watershed
2. Design the gully control structures for controlling the landslides
3. Design the agronomical and mechanical measures for controlling soil erosion
4. Classify the water harvesting structures for insitu and exsitu water conservation
5. Prioritize and execute the watershed development programme with land capability classification for watershed management

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	-	2	-	3		1	1		1			-
2	-	2	-	3	-	1						-
3	3	-	-	2	-	-	-					-
4	2	2	-	3	-		1				-	-
5	-	-	3	2	-		1					

UNIT I **4 Hours**

SOIL CONSERVATION PRACTICES

Types of erosion-Wind erosion: causes, types, factors affecting adverse effects and control-Water erosion: different types, factors affecting effects and control-Methods of gully control- Estimation of soil loss.

UNIT II **4 Hours**

GULLY CONTROL STRUCTURES

Gullies-classification-Gully control and control of landslides, Temporary gully control measures, Permanent Gully Control Structures.

UNIT III **8 Hours**

EROSION CONTROL

Soil Erosion control measures, Contour bunds and Graded bunds, Broad beds and furrows, wide based terraces and dykes, Random tie ridging, basin listing and mulching, Bench terraces, stone walls and contour trenches, - Contour cultivation, strip cropping, mixed cropping, mixed farming, crop rotation for erosion control, Afforestation - Diversion drains and vegetative water ways.

Universal Soil Loss Equation(USLE) & soil loss tolerance, Rainfall Erosion Index, Soil erodibility Index, Slope, slope length and topographical factors, Crop management for soil erosion factor, Conservation practice factor Wind erosion control - wind breaks and shelter belts.

UNIT IV **8 Hours**

WATER CONSERVATION AND HARVESTING

Types of storage structures- Water yield from catchments-Losses of stored water- water conservation methods-water harvesting methods and techniques.

UNIT V **6 Hours**

WATERSHED INTRODUCTION

Definition of watershed-Classification-Basic factors influencing watershed development-concept of priority watersheds-Land capability classification for watershed management.

FOR FURTHER READING

Applications-Basic agronomical measures-Grassland management-watershed development-wasteland development-case studies.

Total: 60 Hours

Reference(s)

1. R. Suresh, Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi,2000.
2. Ghanshyam Das, Hydrology and Soil Conservation Engineering Prentice-Hall of India Pvt Ltd., New Delhi, 2000.
3. Glenn and O. Schwab, Soil and water Conservation Engineering, John Wiley and sons, New York, 1981.
4. B.C., Mal, Introduction to soil and water Conservation Engineering, Kalyani Publishers, New Delhi, 2002.
5. Gurmel Singh et al, Manual of soil and water conservation practices. Oxford & IBH Publishing Co, New Delhi, 1996.
6. A.M. Michael, and T.P. Ojha, Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi, 1980.

15AG307 FLUID MECHANICS AND MACHINERY LABORATORY

0 0 2 1

Course Objectives

- To impart knowledge on flow measurements in pipes and open channels
- To carry out performance studies on hydraulic machineries
- At the end of the course the students will be able to design pipe layouts and design pumps for residential buildings

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Course Outcomes (COs)

1. Measure the flow of water in pipes
2. Determine the characteristics of turbines & pumps
3. Understand the application of Bernoulli's theorem

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2	1	2								
2	3	2	3	2	1							
3	3	2	1	2	2	-						

1 **3 Hours**

EXPERIMENT 1

Find the friction factor of fully developed flow through pipes of various diameters.

2 **3 Hours**

EXPERIMENT 2

Determination of Co-efficient of discharge of Venturimeter

3 **3 Hours**

EXPERIMENT 3

Determination of Co-efficient of discharge of V-notch

4 **3 Hours**

EXPERIMENT 4

Determination of Co-efficient of discharge of orifice meter

5 **3 Hours**

EXPERIMENT 5

Conduct a test and submit the characteristic report on Centrifugal pump

6 **3 Hours**

EXPERIMENT 6

Conduct a test and submit the characteristic report on Submersible pump

7 **3 Hours**

EXPERIMENT 7

Conduct a test and submit the characteristic report on Reciprocating pump

8 **3 Hours**

EXPERIMENT 8

Conduct a test and submit the characteristic report on Jet pump

9 **2 Hours**

EXPERIMENT 9

Conduct a test and submit the characteristic report on Gear Pump

10 **2 Hours**

EXPERIMENT 10

Study on the performance characteristics of Francis turbine

11 **2 Hours**

EXPERIMENT 11

Study on the performance characteristics of Pelton wheel turbine

Total: 30 Hours

Reference(s)

1. Yunus A. Cengel, John M. Cimbala, Fluid Mechanics-Fundamentals and Applications, Tata McGraw Hill Publishing Co., New Delhi, 2006.
2. R.K. Bansal, A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi publications (P) Ltd., New Delhi, 2002.
3. K. Subramanya, Flow in Open Channels, Tata McGraw Hill Publishing Co., New Delhi, 2009.
4. RJ. Grade, Fluid mechanics through problems. Wiley eastern Ltd., Madras, 2002.
5. P.N. Modi and S.M. Seth, Hydraulics and fluid mechanics. Standard Publishers Distributors, New Delhi, v

15AG308 ENGINEERING SURVEY LABORATORY 0 0 2 1

Course Objectives

- To impart knowledge on the basic principles of field surveying procedures
- To impart a clear understanding on the working principles and use of theodolite

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Demonstrate the various functional aspects of surveying instruments
2. Prepare topographic map including contours of any site
3. Perform a highway road alignment project and Calculate the area and volume of earthwork

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1		2	3								
2	1	2	3		3							
3	1		2									

1 **2 Hours**

EXPERIMENT 1

Linear measurement and offset setting

2 **2 Hours**

EXPERIMENT 2

Area computation by cross staff survey and plotting

3 **2 Hours**

EXPERIMENT 3

Chain traversing of cropped area and error correction.

4 **2 Hours**

EXPERIMENT 4

Computation of Area from field notes and plot plan

5 **2 Hours**

EXPERIMENT 5

Mid-ordinate rule, Average ordinate rule, Trapezoidal rule, Simpson rule and Coordinate method of finding area – problems

6 **2 Hours**

EXPERIMENT 6

Compass Survey - radiation method-Closed compass traversing, Plotting and correction of closing error

7 **2 Hours**

EXPERIMENT 7

Open compass traversing-Problems on Compass traversing

8 **2 Hours**

EXPERIMENT 8

Area computation by plane table survey - radiation method

9 **2 Hours**

EXPERIMENT 9

Plane table survey - intersection -Plane table traversing resection methods

10 **2 Hours**

EXPERIMENT 10

Use of Dumpy of level - limitation - handling - shifting- Simple levelling - temporary adjustments

11 **2 Hours**

EXPERIMENT 11

Differential levelling in field- Profile levelling - plotting

12 **2 Hours**

EXPERIMENT 12

Differential levelling problems-Cross-sectioning - plotting

13 **2 Hours**

EXPERIMENT 13

Contouring- Direct and Grid method-Plotting of contour - preparation of map - Computation of volume

14 **2 Hours**

EXPERIMENT 14

Cross sectioning with theodolite and plotting -Traversing with a Theodolite - Plotting theodolite survey

15 **2 Hours**

EXPERIMENT 15

Area and elevation determination by measuring horizontal and vertical angles-Volume of earthwork computation

Total: 30 Hours

Reference(s)

1. Punmia. B.C "Surveying (Vol- I & Vol-II)" Laxmi publications, New Delhi. 1991.
2. Kanetkar, T.P. & Kulkarni, S.V., "Surveying & leveling". Part I, A.V.G. Prakashan, Poona. 1984.
3. Basak. V.N, "Surveying and Levelling", Tata McGraw hill publications, New Delhi. 1994.

15AG309 MINI PROJECT I **0 0 2 1**

Course Objectives

- To develop knowledge to formulate a real world problem and project's goals
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations

Programme Outcomes (POs)

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

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

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		3	2						1		1	
2		3								2	1	

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

Total: 0 Hours

0 0 2 0

15GE310 LIFE SKILLS: BUSINESS ENGLISH

Course Objectives

- To acquire command in both the receptive skills (Listening and Reading)and the productive skills(Writing and Speaking) of English language
- Employ various types of sentences in business correspondence
- To acquire language skills needed for B2 level of the CEFR/ Common European Framework of Reference for Languages

Programme Outcomes (POs)
Course Outcomes (COs)

1. Listen to business conversations and understand specific information and overall idea
2. Read and understand business texts
3. Write coherent business letters, e-mails and reports using appropriate sentence structures and cohesive devices
4. Communicate orally in business situations using necessary verbal and non verbal devices
5. Appear for the Business English Certificate (BEC)Vantage level examination conducted by Cambridge Assessment English

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1												
2												
3												
4												
5												

1 **15 Hours**

UNIT I LISTENING AND READING

Listening for writing short answers - filling gaps in Listening for writing short answers - filling gaps in sentences - identifying topic, context and function - identify different functions of language in business situations - identify prompts -identify paraphrases of required information

Scanning - reading for gist - understanding sentence structure - error identification - identify paraphrases - cohesive words and phrases - understand the importance of analysing the distractors - identify grammatical and semantic relationships

2 **15 Hours**

UNIT II WRITING AND SPEAKING

Business Emails - notes - memos to colleagues or friends - Giving instructions - explaining a development - asking for comments - requesting information - agreeing to requests - explaining - apologising - reassuring - complaining - describing - summarising - recommending - persuading

Turn-taking - sustaining interaction - initiating - responding - giving personal information - Talking about present circumstances, past experiences and future plans - expressing opinion - speculating - organising a larger unit of discourse - giving information - expressing and justifying opinions - speculating - comparing and contrasting - agreeing and disagreeing

Total: 30 Hours

Reference(s)

1. Whitehead, Russell and Michael Black. Pass Cambridge BEC Vantage Self-Study Practice Tests with Key, Heinle,a part of Cengage Learning, Delhi, 2003.

15MA401 NUMERICAL METHODS AND STATISTICS 2 2 0 3

Course Objectives

- By enrolling and studying this course the students will be able to understand the methods to solve polynomial equations and Implement the mathematical ideas for interpolation numerically
- Summarize and apply the methodologies involved in solving problems related to ordinary and partial differential equations
- Apply the concepts testing of hypothesis in their core areas
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

Course Outcomes (COs)

1. Classify the equations into algebraic, transcendental or simultaneous and apply the techniques to solve them numerically
2. Demonstrate and obtain the differentiation and integration of functions using the numerical techniques
3. Obtain the solutions of all types of differential equations, numerically.
4. Apply basic statistical inference techniques, including confidence intervals, hypothesis testing to science/engineering problems.
5. Design an experiment for an appropriate situation using ANOVA technique.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1		-									
2	2	2										
3	3		-									
4	3	3										
5	3		-									

UNIT I **6 Hours**

SOLUTION OF EQUATIONS

Solution of algebraic and transcendental equations: Newton- Raphson method - Solution of system of linear equations: Gauss elimination method - Inverse of a matrix: Gauss-Jordan method- Eigen values of a matrix by Power method.

UNIT II **5 Hours**

INTERPOLATION, DIFFERENTIATIONAND INTEGRATION

Interpolation: Newton's forward and backward interpolation formulae - Numerical differentiation: Newton's forward and backward interpolation formulae.
Numerical integration: Trapezoidal rule- Simpson's rules for single integrals- Two point Gaussian quadrature formula.

UNIT III **7 Hours**

SOLUTIONS OF DIFFERENTIAL EQUATIONS

Solution of first order ordinary differential equations: Fourth order Runge- Kutta method - Solution of partial differential equations: Elliptic equations: Poisson's equation- Parabolic equations by Crank Nicholson method- Hyperbolic equations by explicit finite difference method.

UNIT IV **6 Hours**

TESTING OF HYPOTHESIS

Sampling distributions- Large sample test: Tests for mean- Small sample tests: Tests for mean (t test), F- test- Chi-square test for Goodness of fit and Independence of attributes

UNIT V **6 Hours**

DESIGN OF EXPERIMENTS

Completely randomized design - Randomized block design - Latin square design.

FOR FURTHER READING

Collection of data and use the testing of hypothesis to analyze the characteristics of the data.

Total: 60 Hours

Reference(s)

1. Grewal B. S, Numerical Methods in Engineering and Science with Programms in C & C++, Ninth Edition, Khanna Publications, 2010.
2. Sankara Rao. K, Numerical Methods for Scientists and Engineers, Third Edition, PHI Learning Private Limited, New Delhi, 2009.
3. Gerald C. F and Wheatley P.O, Applied Numerical Analysis, Seventh Edition, Pearson Education, New Delhi, 2004.
4. Johnson R.A, Miller and Freund's Probability and Statistics for Engineers, Seventh Edition, Prentice Hall of India, New Delhi, 2005.
5. Walpole R.E, Myers R.H, Myers R.S.L and Ye K, Probability and Statistics for Engineers and Scientists, Seventh Edition, Pearsons Education, Delhi, 2002.

15AG402 THEORY OF MACHINES 3 0 0 3

Course Objectives

- To impart the knowledge on the concept of simple mechanisms
- To gain the familiarity on gears, gear trains, cams and fly wheel
- To learn about working principle and applications of governors

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

Course Outcomes (COs)

1. students will able to Assess the concepts and types of motions and joints
2. Apply the knowledge of kinematic pairs and linkages in real time situations
3. Design and select suitable types of gears, friction drives, cam and fly wheel
4. Recognize the CAM and fly whelt application in particular region of machines
5. Analyze the forces in governor and gyroscope

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1			1						
2		3		1			1			2		
3	3	1	2			2						
4	2		3	2	1							
5	3	2	2							1		

UNIT I **9 Hours**

INTRODUCTION TO MECHANISM

Definition of a machine-kinematic pair-types-links-types of constrained motion- types of joints-degrees of freedom. Kinematic chain-Classification of kinematic pairs-four bar chain, slider crank chain and their inversions. Mechanical advantages - velocity and acceleration in mechanisms. Determination of velocity and acceleration by relative velocity method for simple four bar mechanism

UNIT II **9 Hours**

FRICTION AND FRICTION DRIVES

Introduction to brakes and clutches Ã¢?? types and applications Power drives-belt drives-types-belt materials. Length of belt-power transmitted-velocity ratio- flat and v-belts. Effect of centrifugal tension-creep and slip on power transmission.

UNIT III **9 Hours**

GEAR AND GEAR TRAINS

Gears-law of gearing-velocity of sliding between two teeth in a mesh. Involute and cycloidal profile for gear teeth. Types of gears- spur gear- gears trains -simple, compound, reverted and epicyclic - determining velocity ratio by tabular method.

UNIT IV **9 Hours**

CAM AND FLYWHEEL

Cam and follower-types-application knife edge, roller and flat faced follower -profiles for uniform velocity and acceleration. Simple harmonic, cycloidal motion. Turning moment diagrams-coefficient of fluctuation of speed and energy- fly wheel and its applications.

UNIT V **9 Hours**

GOVERNORS

Types of governors-constructional details and analysis of Watt, Porter and Proel governors. Sensitiveness, stability, hunting, isochronisms, power and effort of a governor.

FOR FURTHER READING

Automatic Control of Systems-Different types of controls-process control-kinetic control-regulator-transducer-types of control systems-open loop and closed loop monitored systems-carburetor-lag in response-transfer functions.

Total: 45 Hours

Reference(s)

1. S. Rattan, Theory of Machines, Tata McGraw Hill Publishing Company pvt Ltd, New Delhi, 2009
2. R. L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw Hill Publishing Company Pvt Ltd. New Delhi, 2005.
3. Ashok, G. Ambekar, Mechanism and Machine Theory, Prentice Hall of India, New Delhi, 2009.
4. John J. Uichker and Joesph E. Shigley, Theory of Machines and Mechanism, Tata McGraw Hall Publishing Company Pvt Ltd., New Delhi,2005.
5. Sadhu Singh, Theory of Machines, Pearson Education, New Delhi, 2007.
6. R.S.Khurmi and J.K. Gupta, Theory of Machines, Eurasia publishing House Pvt Ltd, New Delhi, 2005.

15AG403 HEAT AND MASS TRANSFER 2 0 2 3

Course Objectives

- To impart the knowledge on heat transfer mechanisms in fluids and solids, and their applications in various heat transfer equipment
- To analyze heat exchangers and methods of evaluating the performance
- To introduce non-dimensional numbers and their effects in governing various modes of mass transfer

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

Course Outcomes (COs)

1. Understand conduction, students will able to in different geometries
2. Asses the concepts and types of convertion in heat transfer mechanism
3. Recognize the radiation problems in various gcomeries
4. Analyze the performance of heat exchangers and evaporators
5. Understand the various modes of mass transfer and apply them in engineering problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	1					-		-	
2	2	3	1	1	1	-			-			
3	3	2	1		1			-		-		

4	1	3	2		-		-		-			
5	3	2	1	1	-			-				

UNIT I **6 Hours**

CONDUCTION

Basic concepts - Mechanism of Heat transfer. Conduction - Fourier's Law, General differential equation in Cartesian and cylindrical coordinates, one dimensional steady state heat conduction, conduction through plane wall, cylinders and spherical systems.

UNIT II **8 Hours**

CONVECTION

Basic Concepts - Heat transfer coefficients, boundary layer concept. Types of convection - Forced convection, dimensional analysis, non-dimensional numbers, external flow, flow over plates, cylinders and spheres, internal flow, laminar and turbulent flow, combined laminar and turbulent.

UNIT III **4 Hours**

RADIATION

Laws of Radiation - Stefan-Boltzmann Law, Kirchhoff's Law Black body radiation - Grey body radiation - Shape factor algebra - Radiation shields.

UNIT IV **6 Hours**

HEAT EXCHANGERS

Heat exchangers - Types, heat exchanger analysis, fouling factor, LMTD (Logarithmic mean temperature difference) and Effectiveness-NTU (number of transfer units) Method - Overall Heat Transfer Coefficient

UNIT V **6 Hours**

MASS TRANSFER

Mass transfer - introduction - Fick's law for molecular diffusion - molecular diffusion in gases - equimolar counters diffusion in gases- diffusion through a varying cross sectional area- diffusion coefficients for gases - molecular diffusion in liquids.

FOR FURHTER READING

Application of Heat and Mass transfer in Food Processing industries

1 **2 Hours**

EXPERIMENT 1

Calculate the thermal conductivity of lagged pipe

2 **2 Hours**

EXPERIMENT 2

Determination of thermal conductivity of metal rod

3 **2 Hours**

EXPERIMENT 3

Calculate the thermal conductivity of insulating material

4 **2 Hours**

EXPERIMENT 4

Determine the thermal conductivity of composite material

5 **2 Hours**

EXPERIMENT 5

Determine the thermal conductivity of guarded hot plate

6 **4 Hours**

EXPERIMENT 6

Determination of heat transfer co-efficient by natural convection

7 **4 Hours**

EXPERIMENT 7

Determination of heat transfer co-efficient by forced convection

8 **4 Hours**

EXPERIMENT 8

Determination of heat exchanger test - parallel and counter flow

9 **4 Hours**

EXPERIMENT 9

Determination of emissivity using emissivity apparatus

10 **4 Hours**

EXPERIMENT 10

Determination of Stefan-Boltzmann constant

Total: 60 Hours

Reference(s)

1. P.L.Bellaney, Thermal Engineering. Khanna Publishers, New Delhi, 2001
2. C.J.Geankoplis, Transport Process and Unit Operations, Prentice-Hall of India Private Limited, New Delhi,1999
3. R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age International private limited, New Delhi, 2010
4. Yunus A. Cengel, Heat and Mass Transfer: a Practical Approach, Tata McGraw Hill publishing Company private limited, New Delhi, 2007
5. J. P. Holman, Heat Transfer, Tata McGraw Hill publishing Company private limited, New Delhi, 2009
6. C. P. Kothandaraman and S. Subramanyan, Fundamentals of Heat and Mass Transfer, New Age International private limited, New Delhi, 2014

15AG404 STRENGTH OF MATERIALS 3 2 0 4

Course Objectives

- To impart knowledge on stress, strain and elastic modulus concepts in various components with sound mathematical principles.
- To provide knowledge on finding shear force, bending moment, deflection and slopes in various types of beams with different load conditions and to the machine components like shafts, columns, springs and their applications.
- To know method of testing the mechanical properties of materials related to hardness, compression, tension, shear and impact.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Apply the concepts of mechanics of deformable solids in different applications.
2. Solve solid mechanics related engineering problems in systematic methods.
3. Determine mechanical properties of materials and structural elements by experiments and analyze/synthesize test results
4. posses knowledge on deflection of beams and columns
5. posses knowledge on torsion in sraft and helical spring

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1	3	-								
2	2	1	3	1	-		-					1
3	2	3	2	-			-			-		
4	2	1	3			-				-		1
5	2	3	1						-		-	1

UNIT I **9 Hours**

STRESS, STRAIN AND DEFORMATION OF SOLIDSSTRESS, STRAIN AND DEFORMATION OF SOLIDS

Introduction to material properties. Stresses and strains due to axial force, shear force, impact force and thermal effect-stepped and composite bars-uniformly varying cross section. Stress-strain curve for ductile and brittle materials - Hooke's law - Factor of safety - Poisson's ratio. Elastic constants and their relationship

UNIT II **9 Hours**

ANALYSIS OF STRESSES IN TWO DIMENSIONS

State of stresses at a point - Normal and shear stresses on inclined planes - Principal planes and stresses - Plane of maximum shear stress - Mohr's circle for biaxial stress with shear stress. Hoop and longitudinal stresses in thin cylindrical and spherical shells - Changes in dimensions and volume

UNIT III **9 Hours**

LOADS AND STRESSES IN BEAMS

Types of beams- Supports and Loads - Shear force and Bending Moment in beams - Cantilever, simply supported and overhanging beams - Point of contra flexure. Theory of simple bending - bending and shear stress - stress variation along the length and section of the beam - Section modulus.

UNIT IV **9 Hours**

DEFLECTION OF BEAMS AND COLUMNS

Slope and Deflection of cantilever, simply supported and overhanging beams-Double integration method and Macaulay's method. Columns - types- Equivalent length - Euler's and Rankine's formulae - Slenderness.

UNIT V **9 Hours**

TORSION IN SHAFT AND HELICAL SPRING

Analysis of torsion of circular solid and hollow shafts-stepped shaft-compound shaft- Shear stress distribution-angle of twist and torsional stiffness. Closed coil helical spring- stresses and deflection under axial load-Maximum shear stress in spring section including Wahl Factor-problems - applications.

FOR FURTHER READING

Fatigue,shear flow,shear center,thick wall pressure vessels and bending of curved beams.open coil spring-stresses and deflection

Total: 75 Hours

Reference(s)

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Learning Pvt Ltd, New Delhi, 2010
2. S.S.Rattan, Strength of Materials, Tata McGraw Hill, Delhi, Second Edition, 2011
3. D. K. Singh, Mechanics of Solids, Pearson Education New Delhi,2006.
4. W.A. Nash, Theory and problems in Strength of Materials, Schaum Outline Series,McGraw-Hill Book Co,New York,1995.
5. F. P. Beer and R. Johnston, Mechanics of Materials, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi,Third edition,2002.
6. B. K. Sarkar, Strength of Materials, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi, Second Reprint, 2007.

15AG405 DESIGN OF FARM STRUCTURES 3 0 0 3

Course Objectives

- To develop theoretical and practical knowledge on the various components of a farmstead
- To understand the application of RCC in various farmstead structures and solve problems including sewage disposal structures
- To gain the knowledge on the design of different types and components of farm structures
- To impart knowledge on design and construction of farm structures

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

Course Outcomes (COs)

1. Plan the farm buildings based on site location, requirements and design the dairy , poultry farm and aqua cultural system
2. Design the various types of food grain storage structures including modern grain storage, silo design based on the requirement and construct the machinery shed including the design of trusses based on the space and building requirements

3. Plan the farm fence and road based on the types, slope and alignment and design the rural culverts of different sizes among its hydraulic and structural aspects
4. Plan the farm fence and road based on the types, slope and alignment and design the rural culverts of different sizes among its hydraulic and structural aspects
5. Apply the knowledge on design of RCC structures for constructing various farmstead structures

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3	3	2	1	1						1
2	2	3	3	2	1	1	-					1
3	2	3	3	1	2	1	-					1
4	2	3	3	1	2	1	-		-			1
5	2	3	3	1	2	1						1

UNIT I **9 Hours**

FARMSTEAD PLANNING AND FARM HOUSES

Different types of farm buildings- farm site selection- building arrangement. Planning and designing dairy barns- stall barns and loose houses- milking parlor-waste management -poultry housing requirements- common types of poultry houses and their planning- introduction to aquacultural systems

UNIT II **9 Hours**

FARM FEED AND GRAIN STORAGE STRUCTURES

Indigenous food grain storage structures - need for good storage- modern grain storage and concrete bins- threshing and drying floors. Silo-requirement- Types of silo, over ground, underground and others. Design of silos- covered an open spaces - Machinery sheds - Site selection - Types and shapes of building - Space requirements. Farm shops, building requirement and space requirement. Farm trusses- Types; King post truss, queen post truss and trusses for workshops and other conditions and their design.

UNIT III **9 Hours**

FARM FENCING AND ROADS

Fencing, types of fences-fence posts. Survey and planning of fences- survey and planning of roads - alignment of roads - slope of roads - plain and hilly roads - camber - Geometrical design - Pavement design - Construction, repair and maintenance - Typical rural culverts of different sizes, their hydraulic and structural design and construction.

UNIT IV **9 Hours**

WATER SUPPLY AND SEWAGE DISPOSAL

Sources of water supply - Estimation of quantity for different consumption - capacity requirements of storage tanks - distribution systems - Design of septic tanks and sanitary structures

UNIT V **9 Hours**

DESIGN OF RCC STRUCTURES

Properties of Reinforced concrete - Basic assumptions - Modular ratio - Singly reinforced beam - fundamental assumptions - Equivalent area of R.C.C. section - Design of Singly reinforced beam - main reinforcement - vertical stirrups. Design of one way slabs - main and distribution reinforcement calculation and construction

FOR FURTHER READING

Case studies-Farm structure construction-Instrumentation and automation in Green house-Green house technology -Global context- India

Total: 45 Hours

Reference(s)

1. T.P.Ojha and A.M.Michael, Principles of Agricultural Engineering, Vol-1, Jain brothers, New Delhi,2006
2. H.N. Van Lier, Ã¢??CIGR Handbook of Agricultural Engineering, Vol. I- Land and Water Management EngineeringÃ¢??, ASAE, USA. 1999
3. E. H. Bartali and W.Frederick, Ã¢??CIGR Handbook of Agricultural Engineering, Vol. II- Animal Production and Aquacultural EngineeringÃ¢??, ASAE, USA. 1999
4. M.Raghupathi, Ã¢??Design of steel structuresÃ¢?? Tata McGraw Hill Pub. Com. New Delhi 110 006 2005
5. B.C.Punmia, Ã¢??Reinforced concrete structures Ã¢?? Vol. IÃ¢?? Laxmi publications, 7/21, Ansari Road, Dhryaganj, New Delhi 110 002, 2005
6. Christian Von Zabeltitz and W.O.Baudoin,"Green houses and shelter structures for tropical regions", FAO plant production and protection paper, Rome,1999

15AG406 IRRIGATION AND DRAINAGE ENGINEERING

3 0 0 3

Course Objectives

- To acquire a fundamental understanding of different irrigation methods
- To learn about the importance of drainage in crop production and the need to control water logging and salinization
- To develop skills on design of different irrigation and drainage systems
- To gain the knowledge on management of irrigation and drainage systems

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Explain the development and utilization of water resources in India as well as Tamil Nadu and estimate the evapo-transpiration using direct and indirect methods for scheduling the irrigation for various crops
2. Determine irrigation requirements of crops and plan the irrigation schedule for different crops including irrigation efficiencies.
3. Design different methods of surface irrigation and their adaptability to the specific characteristics of soil, topography and crops
4. Execute the command area development works including on farm development works, maintenance and its economics and water distribution system like warabhandhi and rotational waters supply system
5. Design, monitor and maintain the surface and sub surface drainage systems for controlling the salinity and water logging in the agricultural area.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3	2	2	1	1						1

2	2	3	2	2	1	1			-			1
3	1	2	3	2	2		-					
4	2	2	3	1			-					2
5	2	1	3	2			-					1

UNIT I **9 Hours**

WATER RESOURCE

Water Resources- River basins-Development and Utilization in India and Tamil Nadu-Irrigation - duty and delta - Rooting characteristics-Moisture use of crop, Evapotranspiration - ET - Penman-montieth equation, Blaney-criddle method.

UNIT II **9 Hours**

IRRIGATION REQUIREMENT

Crop water requirement, Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies

UNIT III **9 Hours**

METHODS OF IRRIGATION

Methods of Irrigation - Border irrigation, Infiltration, Flow Retardance, Advances of water front, Recession flow, Hydraulics and design & furrow irrigation, Deep percolation losses, Run off losses, Hydraulics and design -Land grading - Land levelling methods

UNIT IV **9 Hours**

COMMAND AREA DEVELOPMENT

Command area - Concept, Components of CADA - CADA programmes in Tamil Nadu - On Farm Development works,Materials for lining water courses and field channel, Water control and diversion structure Execution - maintenance and economics of OFD WORKS, Farmer's committee and its role for water distribution and system operation, Strategic outlet command - stream size for efficient warabandhi and rotational irrigation system.

UNIT V **9 Hours**

AGRICULTURAL DRAINAGE AND SYSTEM

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

FOR FURTHER READING

GIS- concept-use of GIS for identifying the areas that need drainage-design of drainage systems based on the data obtained through remote sensing from satellites.

1 **2 Hours**

EXPERIMENT 1

Identification of different crops, seeds, manures and fertilizers

2 **2 Hours**

EXPERIMENT 2

Working out seed rate and fertilizer schedule for major crops of wet, garden and dry lands

3 **2 Hours**

EXPERIMENT 3

Study of meteorological instruments

4 **2 Hours**

EXPERIMENT 4

Study of farm tools and implements

5 **2 Hours**

EXPERIMENT 5

Study on different methods of seed treatment, sowing and planting

6 **2 Hours**

EXPERIMENT 6

Visit to wet land to learn important cropping systems and Hi Tech nursery

7 **2 Hours**

EXPERIMENT 7

Visit to irrigated dryland cropping systems and irrigation methods

8 **2 Hours**

EXPERIMENT 8

Horticultural tools and implements used for various operations.

9 **2 Hours**

EXPERIMENT 9

Study on Commercial propagation techniques in horticultural crops - layering and cutting.

10 **2 Hours**

EXPERIMENT 10

Study of Propagation methods- budding and grafting and pruning in horticultural crops

11 **2 Hours**

EXPERIMENT 11

Study on irrigation, fertilizer application and weed management practices in horticultural crops

12 **2 Hours**

EXPERIMENT 12

Study on maturity indices for harvesting of horticultural crops

13 **2 Hours**

EXPERIMENT 13

Study on maintenance of lawn, hedges and edges through machineries and Plant propagation structures

14 **2 Hours**

EXPERIMENT 14

Visit to private orchards to identify different features of orchard.

15 **2 Hours**

EXPERIMENT 15

Visit of to a regulated market

Total: 75 Hours

Reference(s)

1. A.M.Michael, 2010. Irrigation - Theory and practice, Vikas publishers, New Delhi
2. Ravikumar. V, M.V.Ranghaswami, K.Appavu and S.Chellamuthu, 2011, Microirrigation& Irrigation Pumps, Kalyani publishers, Ludhiana
3. Dilip Kumar Majumdar, Irrigation water Management-Principles and Practice, Prentice-Hall of India Pvt. Ltd, New Delhi, 2006 Agrobios publishers, Ludhiana, 2001.
4. Michael Raviv and Heinrich Lieth. J. ,2013, Soil less culture, Theory and Practice, Elsevier
5. Jack Keller and RondBleisner 1990. Sprinkler and Trickle irrigation, Van Nostrand Reinhold, New York
6. Modi, P.N. and Seth, S.M. 2010, Hydraulics and fluid mechanics, Standard book house, New Delhi

15AG407 CROP HUSBANDRY LABORATORY 0 0 4 2

Course Objectives

- To study about field crops and cultivation aspects.
- To learn the management of crops including soil management and to control the diseases to increase the food production
- To acquire the knowledge on the nursery production of herbaceous and woody plants for landscape design and management

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

1. Possess the knowledge on the agronomic practices for raising different crops and intensive cultivation through use of improved varieties and the liberal use of irrigation and fertilizers to increase the food production.
2. Utilize the knowledge on rainfed and dry land agriculture and precision farming.
3. Possess the knowledge on the commercial production of high-value horticultural crops such as fruits, vegetables, cut flowers, potted plants, bedding plants, and bulbs and floral design.
4. Possess the knowledge on harvesting methods, pre cooling, packaging and storage of horticultural crops.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1		2								
2	1	3										
3	2		1									
4	3	1										

1 **4 Hours**

EXPERIMENT 1

Identification of different crops, seeds, manures and fertilizers

2 **4 Hours**

EXPERIMENT 2

Practicing cultivation of rice / maize / pulse crops to raise in new Agri. field area from seed to harvest

3 **4 Hours**

EXPERIMENT 3

Identification of meteorological instruments

4 **4 Hours**

EXPERIMENT 4

Identification of farm tools and implements, primary and secondary tillage

5 **4 Hours**

EXPERIMENT 5

Practicing different methods of sowing and planting

6 **4 Hours**

EXPERIMENT 6

Cultivation techniques of rice / cereals / pulses crops

7 **4 Hours**

EXPERIMENT 7

Cultivation techniques of oil seed crops and fiber crops

8 **4 Hours**

EXPERIMENT 8

Cultivation of sugar and fodder crops

9 **4 Hours**

EXPERIMENT 9

Cropping systems: Monoculture, inter, mixed, relay, strip and multiple cropping systems, advantages

10 **4 Hours**

EXPERIMENT 10

Irrigation, fertilizer application and weed management practices

11 **4 Hours**

EXPERIMENT 11

Assessing maturity indices for harvesting of agricultural crops

12 **4 Hours**

EXPERIMENT 12

Workout the cost of cultivation of major field crops.

13 **4 Hours**

EXPERIMENT 13

Harvesting and post Ã¢?? harvest technology in field crops.

14 **4 Hours**

EXPERIMENT 14

Visit to multi crop station

15 **4 Hours**

EXPERIMENT 15

Visit to private fields

Total: 60 Hours

Reference(s)

1. Chandrasekaran, B., K. Annadurai and E. Somasundaram, A Text book of Agronomy, Scientific publishers, Jodhpur, 2007.
2. P.Balasubramain and SP. Palniappan, Principles and Practices of Agronomy, Agrobios publishers, Ludhiana, 2001.
3. T.Yellamanda Reddy and G.H. Sankara Reddi, Principles of Agronomy, Kalyani publishers, Ludhiana, 2005
4. S.Sankaran and V.T Subbaiah Mudaliar, Principles of Agronomy, The Bangalore Printing and Pub. Co., Bangalore, 1993.
5. SP. Palaniappan, and S. Sivaraman, Cropping systems in the tropics- Principles and Management, New Age international publishers, New Delhi, (2nd edition), 1998.
6. George Acquaah, Horticulture-principles and practices, Prentice-Half of India Pvt. Ltd., New Delhi, 2002.

15AG408 IRRIGATION AND DRAINAGE ENGINEERING LABORATORY

0 0 2 1

Course Objectives

- To acquire a fundamental understanding of different irrigation methods
- To learn about the importance of drainage in crop production and the need to control water logging and salinization
- To develop skills on design of different irrigation and drainage systems
- To gain the knowledge on management of irrigation and drainage systems

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Design and construct irrigation structures
2. Possess a good understanding of the factors related to drainage, essential to design, construct and manage a drainage system.
3. Design, monitor and maintain drainage systems
4. Determine water requirements of crops and the irrigation schedule for different crops

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2	3	2	1							
2	2	3	1	2	2							
3	2	2	3	2	1							
4	3	3	2	1								1

1 **2 Hours**

EXPERIMENT 1

Study of River basins, irrigation projects, irrigation tanks and water resources in Tamil Nadu.

2 **2 Hours**

EXPERIMENT 2

Determination of soil moisture by different methods -gravimetric and tensiometer, block and neutron probe method.

3 **2 Hours**

EXPERIMENT 3

Problems on duty of water - Duty and delta relationship

4 **2 Hours**

EXPERIMENT 4

Estimation of water requirement by different methods

5 **2 Hours**

EXPERIMENT 5

Estimation of Evapotranspiration

6 **2 Hours**

EXPERIMENT 6

Land Levelling Plane method from climatologically data

7 **2 Hours**

EXPERIMENT 7

Determination of irrigation efficiencies and design of basin and furrow irrigation systems

8 **2 Hours**

EXPERIMENT 8

Problems on irrigation efficiencies and design of border irrigation systems

9 **2 Hours**

EXPERIMENT 9

Design of Basin and Furrow irrigation - Problems

10 **2 Hours**

EXPERIMENT 10

Design of underground pipeline system.

11 **2 Hours**

EXPERIMENT 11

Problems on Irrigation scheduling

12 **2 Hours**

EXPERIMENT 12
OFD works in command areas

13 **2 Hours**

EXPERIMENT 13
Design of surface and sub-surface drainage systems.

14 **2 Hours**

EXPERIMENT 14
Field visit to command areas and observation of OFD works.

15 **2 Hours**

EXPERIMENT 15
Measurement of water flow using V- notch, rectangular notch, circular notch and parshall flume

Total: 30 Hours

Reference(s)

1. Dilip Kumar Majumdar, Irrigation water Management-Principles and Practice, Prentice-Hall of India Pvt Ltd, New Delhi, 2006
2. J.N. Luthin, Drainage Engineering, John Wiley and Sons, New York, 1966.
3. A.M. Michael, Irrigation -Theory and Practice, Vikas publishing house, New Delhi, 1990.
4. V.V.N. Murthy, Land and water management, Kalyani publishing, New Delhi, 1998.

15AG409 MINI PROJECT II 0 0 2 1

Course Objectives

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

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

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	3	2	-			-		-		-
2	3	2	1	2	-			-			-	-
3	2	1			3				-			-
4	2	1	2	3						-		-
5	1		1		-				2	3		-

Total: 0 Hours

0 0 2 0

15GE410 LIFE SKILLS: VERBAL ABILITY

Course Objectives

- Read and understand business passages
- Employ various types of sentences in Business Correspondence
- Equip students with strategies for vocabulary development

Programme Outcomes (POs)

Course Outcomes (COs)

1. Read and understand business related articles
2. Identify errors in the given sentences
3. Attempt vocabulary related questions in competitive exams
4. Write coherent business letters, e-mails, reports and proposals
5. Write instructions and descriptions related to business contexts

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1												
2												
3												
4												
5												

1 **15 Hours**

UNIT 1

Synonyms - Antonyms - Word groups - Verbal analogies - Etymology - Critical Reasoning - Cloze Test - One Word Substitutes - Idioms and Phrases - Text and Paragraph Completion

2 **15 Hours**

UNIT 2

Sentence formation - Paragraph formation- Change of voice - Change of Speech - Reading Comprehension - Sentence Equivalence - Jumbled Sentences - Spotting Errors - Homophones - Homonyms - Commonly Mispronounced/Misspelt Words

Total: 30 Hours

Reference(s)

1. Raymond Murphy. English Grammer in use - A self study reference and Practice book for intermediate learners of English IVed. United Kingdom: Cambridge University Press. 2012.
2. Lewis, Norman. Word Power Made Easy. Goyal Saab Publisher, 2011.
3. Baron's the Official Guide for New GMAT Review 2015. New Jersey : John Wiley & Sons, Inc.

15AG501 UNIT OPERATIONS IN FOOD PROCESS ENGINEERING

3 0 0 3

Course Objectives

- To introduce scope, importance and key concepts of agro processing
- To expose the fundamentals of various unit operations of processing industries such as evaporation, concentration, mechanical separation, size reduction equipment, etc.
- acquire the knowledge on distillation, membrane separation needed for the extraction of liquid fuels such as ethanol, methanol, etc

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Examine the evaporation process and types of evaporators for food industry
2. Analyze the principles of filtration and mechanical separation equipment
3. Identify size reduction and grinding equipment and understand the factors affecting the process
4. Identify the gas-liquid and solid-liquid equilibrium concepts and factors influencing equilibrium separation process.
5. Differentiate crystallization and distillation processes and identify processing equipment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3			1		1					
2		3	2	1			1					
3	2	1	3				1		-		-	-
4	2	1		3			1					
5	2	1	1	3			1					

UNIT I **8 Hours**

EVAPORATION AND CONCENTRATION

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- types of evaporators- performance of evaporators and boiling point elevation - capacity - economy and heat balance - evaporation of heat sensitive materials

UNIT II **8 Hours**

MECHANICAL SEPARATION

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 **9 Hours**

SIZE REDUCTION AND MIXING

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 equipment - crushers - jaw crusher, gyratory crusher-crushing rolls - Grinders - hammer mills - rolling compression mills - attrition, rod, ball and tube mills - construction and operation. Mixing - Characteristics of mixtures - Measurement of mixing sample size, sample compositions - Particle mixing - mixing index - Rates of Mixing - mixing times - Energy Input in Mixing - equipment

UNIT IV **10 Hours**

CONTACT EQUILIBRIUM SEPARATION

Contact equilibrium separation processes - concentrations - gas-liquid and solid-liquid equilibrium - equilibrium concentration relationships - operating conditions-calculation of separation in contact equilibrium processes-gas absorption - rate of gas absorption - stage - equilibrium gas absorption and 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 - equipment

UNIT V **10 Hours**

CRYSTALLIZATION AND DISTILLATION

Crystallization - equilibrium -solubility and equilibrium diagram - rate of crystal growth - equilibrium crystallization-crystallization equipment - classification - construction and operation-tank, agitated batch, Swenson-Walker vacuum crystallizers - distillation - binary mixtures - flash and differential distillation-steam distillation - theory - consumption - continuous distillation with rectification - vacuum distillation - batch distillation - operation and process - advantages and limitations -azeotropic distillation-distillation equipment - construction and operation - factors influencing the operation

FOR FURTHER READING

Unit operations involved in various food processing.

Total: 45 Hours

Reference(s)

1. Geankoplis,C.J., Transport Process and Unit Operations, Prentice-Hall of India Private Limited, New Delhi, 1999
2. Coulson,J.M. and J.F. Richardson, Chemical Engineering, Volume I to V. The Pergamon Press, New York, 1999

15AG502 TRACTORS AND FARM ENGINES 3 0 0 3

Course Objectives

- To acquire an in-depth knowledge on farm tractors and engine systems
- To develop skills on safe and efficient use of tractors
- To acquire knowledge on test procedures to assess the performance of tractors and power tillers

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

Course Outcomes (COs)

1. Explain on tractors, power tillers and their functions
2. Identify and rectify problems in the functioning of tractors and power tillers
3. Assess the performance of tractors and power tillers
4. Summarize ergonomic aspects of tractors and power tillers
5. Examine the cost economics of tractor and power tiller operations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2			2							1
2	3	2			2	1						1
3	1	2	1					3				
4					3	2						
5		-		2						3		

UNIT I **9 Hours**

INTRODUCTION

Classification of tractors - history of Engines- tractor engines - engine operation- understanding the working principle of a diesel engine - 4 Stroke compression-ignition engine cycle- inlet and outlet valves - valve timing diagram- engine efficiency - engine operating cycle - firing order - firing interval - combustion chambers - construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft.

UNIT II **10 Hours**

TRACTOR ENGINE SYSTEMS

Valve and valve mechanism - Air and fuel supply - air cleaner - fuel pump - exhaust - silencer.Cooling and lubrication system - starting and electrical system- Transmission system- clutches, brakes, power train-transmission- gears- types of high and low gears transmission- gear box- differential and final drive mechanism-engine governing. Steering geometry - steering systems - front axle and wheel alignment. Brake - types

UNIT III **10 Hours**

POWER OUTLETS AND TRACTOR CONTROL

Tractor PTO, belt-pulley, properties of hydraulic fluids - Hydraulic system -hydraulic couplings, Torque convertors - Hydraulic circuits- position and draft control- weight transfer- theory of traction - tractive efficiency - tractor chassis mechanics - stability - longitudinal and lateral. Controls - visibility - operator's seat. Tractor steering mechanism - Types - caster camber - king pin inclination - toe-in and toe-out - Tractor Hitching

UNIT IV **10 Hours**

TESTING OF POWER TILLER AND TRACTOR

Power tiller - special features - clutch - gear box - steering and brake. Makes of tractors and power tillers. Types of tests - test procedure - need for testing and evaluation of farm tractor - Test codes for performance testing of tractors and power tillers. Cost of operation of tractors and power tillers

UNIT V **6 Hours**

ERGONOMICS AND ENVIRONMENTAL PROTECTION

Ergonomic aspects of tractors and power tillers-substitution of fossil fuels with biofuels to protect the environment from GHG pollution-case studies

FOR FURTHER READING

Testing procedures available at Bhudni tractor testing centre, Madhya Pradesh- comparative evaluation of specifications of different tractors and power tillers

Total: 45 Hours

Reference(s)

1. Rajeev Kumar, Farm Power and Machinery Engineering (English), First Edition, Standard publishers and distributors, New Delhi. ISBN-10 8180140253, 2008
2. Arun Dahake, An Introduction to Farm Power and Machinery, ISBN No. 9781312800885, (Standard Copyright License), 1st Edition, www.lulu.com, 2015
3. Donnell Hunt, Farm Power and Machinery Management, Publisher: Iowa State Press, ISBN 0813805821, 1995.
4. Barger,E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units, Wiley Eastern Pvt. Ltd., New Delhi, 1997
5. Jain,S.C. and C.R. Rai, Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi, 1999

15AG503 FARM IMPLEMENTS AND EQUIPMENTS 3 0 2 4

Course Objectives

- To learn about the different types of primary and secondary tillage implements, farm equipment and different ploughing methods
- To know about the tools and techniques used for a wide variety of different types of farming operations and landscaping
- To utilise the power tools and mounted implements with the tractor

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Examine the need of farm mechanization and need of tillage
2. Identify the primary tillage implements and explain the working principles based on soil conditions
3. Identify the secondary tillage implements and summarize the working principles based on soil conditions
4. Classify the seeding machines based on the seed metering device and distinguish the sprayers based on power source
5. Test the efficiency of farm implements in field condition based on various parameters

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	1	-	2		-	-			-
2	3	1	1		2	2			-		-	-
3	3	2	1	2	-	2		-				
4	3	1	1			2						
5	3		2			1						

UNIT I **8 Hours**

FARM MECHANIZATION

Farm mechanization - objectives. Tillage - objectives - methods - primary tillage implements - secondary tillage implements - animal drawn ploughs - construction. Types of farm implements - trailed, mounted and semi mounted implements. Field capacity

UNIT II **10 Hours**

PRIMARY TILLAGE IMPLEMENTS

Mould board plough- attachments - mould board shapes and types. Forces acting on tillage tool- mould board plough. Disc plough - force representation on disc - Types of disc ploughs - Subsoiler, chisel plough - Rotary plough - spading machine - coir pith applicators.

UNIT III **10 Hours**

SECONDARY TILLAGE IMPLEMENTS

Cultivators - types - construction - adjustments. Disc harrows - Bund former - ridger - leveller. Basin lister - Wetland preparation implements - puddler - cage wheel - leveller. Hitch systems - vertical and horizontal hitching of pull type and mounted implements- force analysis on trailed, mounted and semi mounted implements.

UNIT IV **9 Hours**

SOWING AND INTERCULTURAL EQUIPMENT

Crop planting - methods - row crop planting systems. Seeding machines- Devices for metering seeds - furrow openers - furrow closers - types - Types of seed drills and planters-seed drill calibration - application of fertilizers - metering devices - seed cum fertilizer drill - application of liquid fertilizers. Plant protection equipment - sprayer - classification - types - duster - types - weeders - manual, power operated - wet, dry land.

UNIT V **8 Hours**

HARVESTING, THRESHING AND TESTING OF FARM IMPLEMENTS

Combine harvester - paddy, sugarcane, maize - grains harvester - thresher - multi crop thresher - digger - tapioca, potato, onion - cotton picker, groundnut harvester - fruit harvesting equipment. Testing of primary tillage equipment - MB plough, disc, chisel and sub soiler plough. Testing of secondary tillage equipment - cultivator, rotavator, disc harrow, testing of seed cum fertilizer drill, planter, sprayer.

FOR FURTHER READING

Ergonomics and Automation - Ergonomic aspects of farm implements - automation of agricultural machinery - latest developments in automation by referring to international and national journals in agricultural engineering

1 **2 Hours**

EXPERIMENT 1

Operation of an animal drawn plough, measuring the draft

2 **2 Hours**

EXPERIMENT 2

Operation of a tractor drawn mould board plough - adjustments - determination of field capacity

3 **2 Hours**

EXPERIMENT 3

Operation of a tractor drawn disc plough - adjustments - determination of field capacity

4 **2 Hours**

EXPERIMENT 4

Hitching of mounted implements to the tractor and ploughing with mounted implements

5 **2 Hours**

EXPERIMENT 5

Operation of tractor drawn cultivator - adjustments- and determination of field capacity

6 **2 Hours**

EXPERIMENT 6

Operation of a subsoiler - adjustments - determination of field capacity

7 **2 Hours**

EXPERIMENT 7

Experiment on Calibration of seed drills

8 **2 Hours**

EXPERIMENT 8

Operation of seed planter and centrifugal broadcasting device in the field

9 **2 Hours**

EXPERIMENT 9

Operation of paddy transplanter and drum seeder in the field and determination of field capacity

10 **2 Hours**

EXPERIMENT 10

Study of wetland implements - puddlers and tramplers

11 **2 Hours**

EXPERIMENT 11

Operation and evaluation of dry land weeders and power operated weeder

12 **2 Hours**

EXPERIMENT 12

Dismantling, parts identification and assembly of different components of knapsack power sprayer and duster

13 **2 Hours**

EXPERIMENT 13

Field-testing of rocker arm sprayer, power sprayer and boom sprayer and their maintenance

14 **2 Hours**

EXPERIMENT 14

Study of different types of nozzles and analysis of spray pattern

15 **2 Hours**

EXPERIMENT 15

Determination of operational cost of farm implements

Total: 75 Hours

Reference(s)

1. Lal, Radhey and Dutta, A.C. Agricultural Engineering through solved examples, Saroj Prakashan Publishers, Allahabad, 1971
2. Krutz, Gary, Thompson Lester and Claar, Paul, Design of Agricultural Machinery", John Wiley and Sons, 1984

15AG504 HYDROLOGY 3 2 0 4

Course Objectives

- To acquire knowledge about the fundamentals of water occurrence and their exploitation
- To understand the hydrology of surface and ground water
- To understand well hydraulics so as to locate wells for the extraction of ground water

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Explain the hydrologic cycle and measure the interception losses including evaporation, transpiration, infiltration and infiltration indices
2. Classify the methods of estimation of runoff and construct the hydrographs based on different methods
3. Distinguish types of geological formations classify the aquifer based on the occurrence of groundwater
4. Assess the ground water flow and estimate the aquifer parameters by following various methods based on the groundwater movement and geological formation
5. Inspect the well losses and yield for well development and design of open and bore well including its diameters, depth and screen

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2		1		1	1		1			
2	1	2	2	3		1						
3	3	-	3	2								
4	2	2		3			1					
5		-	3	2			1					

UNIT I **9 Hours**

HYDROLOGIC CYCLE AND INITIAL LOSSES

Hydrologic cycle - Precipitation - Forms and measurement of precipitation - Water losses interception loss, evaporation, transpiration - infiltration - infiltration capacity - mechanics of infiltration. Factors influencing the rate of infiltration - measurement of infiltration - infiltration equations - Infiltration indices - index - W index - problems.

UNIT II **9 Hours**

RUNOFF AND HYDROGRAPH

Stream types - run off process - phases of runoff process - factors affecting run off - Different methods of Estimation of runoff - Intensity, duration, frequency relationship - Estimation of runoff by empirical formulae - Stream flow and stream gauging - Hydrograph - Hydrograph components - base flow separation - Unit hydrograph - unit hydrograph theory - purposes of unit hydrograph - Derivation of unit hydrograph for multiple durations from unit hydrograph of specified duration - super position technique and 'S' curve method.

UNIT III **9 Hours**

AQUIFERS

Groundwater development in India - occurrence of groundwater - Types of aquifer - confined - unconfined - perched - artesian - aquifuge - aquiclude - Movement of ground water.

UNIT IV **9 Hours**

GROUNDWATER FLOW

Groundwater- development- potential in India, Aquifer properties, Land subsidence due to groundwater withdrawal. Types of aquifer - Movement of groundwater - Darcy's law. Anisotropy, Water table contour maps, Flow net analysis. Groundwater flow potential, unconfined-steady 1-d flow- with recharge, confined 1d-flow. Continuity equation-derivation. Hydraulics of wells , steady-radial flow into wells, unsteady state confined aquifer - Theis method, Jacob method.

UNIT V **9 Hours**

WELLS

Recuperation test, Leaky artesian aquifer-unsteady radial flow. Unconfined aquifer- unsteady radial flow, Image well theory. Partially penetrating wells, Well losses-Step draw down test- yield. Geophysical investigation-Surface methods, Subsurface methods, Wells - design-diameter, depth, screen, Open well versus bore wells, design-bore wells, infiltration galleries, Well development - yield testing.

FOR FURTHER READING

Flood routing and reservoir operation, well drilling machineries pumps and their maintenance.

1 **2 Hours**

EXPERIMENT 1

Problems on solar time â€“ basic earth sun angles

2 **2 Hours**

EXPERIMENT 2

Study of radiation measuring instruments â€“ Visit to meteorology section

3 **2 Hours**

EXPERIMENT 3

Solving problems on thermal losses and efficiency of flat plate collectors

4 **2 Hours**

EXPERIMENT 4

Determination of thermal efficiency of solar water heater

5 **2 Hours**

EXPERIMENT 5

Determination of thermal efficiency of natural convection solar dryer

6 **2 Hours**

EXPERIMENT 6

Determination of thermal efficiency of forced convection solar dryer

7 **2 Hours**

EXPERIMENT 7

Determination of thermal efficiency of solar still

8 **2 Hours**

EXPERIMENT 8

Study of photovoltaic cell characteristics

9 **2 Hours**

EXPERIMENT 9

Study on the performance of wind generator in the lab

10 **2 Hours**

EXPERIMENT 10

Performance evaluation of a SPV water pumping system

11 **2 Hours**

EXPERIMENT 11

Wind Energy conversion calculations for power generation

12 **2 Hours**

EXPERIMENT 12
Design of rotor blade for horizontal axis wind mill

13 **2 Hours**

EXPERIMENT 13
Study of wind measuring instruments

14 **2 Hours**

EXPERIMENT 14
Visit to a solar PV power plant

15 **2 Hours**

EXPERIMENT 15
Visit to a wind farm

Total: 105 Hours

Reference(s)

1. Subramanya, K., Engineering Hydrology, Tata McGraw Hill pub Co. New Delhi, 2004
2. Raghunath, H.M., Groundwater, Wiley Eastern Ltd. Madras, 2003
3. Gurmel Singh et al.Manual of soil and water conservation practices, Oxford & IBH publishing Co. New Delhi,2005
4. Suresh, R.Land and water management principles, Standard Publishers & Distributors, New Delhi,2008

15AG507 UNIT OPERATIONS IN FOOD PROCESS ENGINEERING LABORATORY

0 0 2 1

Course Objectives

- To introduce scope, importance and key concepts of agro processing
- To expose the fundamentals of various unit operations of processing industries such as evaporation, concentration, mechanical separation, size reduction equipment, etc.
- To acquire the knowledge on distillation, membrane separation needed for the extraction of liquid fuels such as ethanol, methanol, etc.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Examine the evaporation process and types of evaporators for food industry
2. Analyze the principles of filtration and mechanical separation equipment
3. Identify size reduction and grinding equipment and understand the factors affecting the process
4. Identify the gas-liquid and solid-liquid equilibrium concepts and factors influencing equilibrium separation process.
5. Differentiate crystallization and distillation processes and identify processing equipment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3	1	2	-		1					
2	2	3	2	2			1					
3	2	3	1	2	2		1					
4	2	3	1		2	-	1					
5	2	3	1		2	-						

1 **2 Hours**

EXPERIMENT 1

Determination of thermal efficiency and economy of evaporator

2 **2 Hours**

EXPERIMENT 2

Problems on single effect and multiple effect evaporators

3 **2 Hours**

EXPERIMENT 3

Determination of separation efficiency of centrifugal separator

4 **2 Hours**

EXPERIMENT 4

Determination of collection efficiency in cyclone separator

5 **2 Hours**

EXPERIMENT 5

Determination of efficiency of liquid-solid separation by filtration

6 **2 Hours**

EXPERIMENT 6

Determination of absorption efficiency in a packing tower

7 **2 Hours**

EXPERIMENT 7

Performance evaluation of a sieve and determination of particle size of granular foods by sieve analysis

8 **2 Hours**

EXPERIMENT 8

Determination of energy requirement in size reduction using the burr mill

9 **2 Hours**

EXPERIMENT 9

Determination of energy requirement in size reduction using the ball mill and hammer mill

10 **2 Hours**

EXPERIMENT 10

Determination of mixing index for solids and pastes

11 **2 Hours**

EXPERIMENT 11

Determination of economy and thermal efficiency of rotary flash evaporator for concentration of juice

12 **2 Hours**

EXPERIMENT 12

Performance evaluation of a steam distillation process

13 **2 Hours**

EXPERIMENT 13

Visit to a solvent extraction industry

14 **2 Hours**

EXPERIMENT 14

Visit to a membrane separation based industry

15 **2 Hours**

EXPERIMENT 15

Visit to a sugar industry

Total: 30 Hours

15AG508 TRACTORS AND FARM ENGINES LABORATORY 0 0 2 1

Course Objectives

- To acquire an in-depth knowledge on farm tractors and engine systems
- To develop skills on safe and efficient use of tractors
- To acquire knowledge on test procedures to assess the performance of tractors and power tillers

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Explain on tractors, power tillers and their functions
2. Identify and rectify problems in the functioning of tractors and power tillers
3. Summarize ergonomic aspects of tractors and power tillers

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2		1									
2	2	3										
3	1		2			1	1					

1 **2 Hours**

EXPERIMENT 1

Hand tools used in garage - fault diagnosis

2 **2 Hours**

EXPERIMENT 2

Dismantling of engine from tractor - engine disassembly(CI engine)

3 **2 Hours**

EXPERIMENT 3

Piston and cylinder- inspection - reconditioning and assembly of cranking system.

4 **2 Hours**

EXPERIMENT 4

Reconditioning and assembly of valve and valve actuation system

5 **2 Hours**

EXPERIMENT 5

Servicing of fuel system assembly and adjustment

6 **2 Hours**

EXPERIMENT 6

Servicing and assembly of lubricating system components

7 **2 Hours**

EXPERIMENT 7

Servicing and assembly of cooling system components

8 **2 Hours**

EXPERIMENT 8

Study of Gear transmission train - clutch - dismantling, inspection and reconditioning - adjustment

9 **2 Hours**

EXPERIMENT 9

Dismantling of transmission system-assembly of gear box, differential and final drive

10 **2 Hours**

EXPERIMENT 10

Brake and its adjustment-Steering system - assembly and adjustment-wheel tread adjustment

11 **2 Hours**

EXPERIMENT 11

Study of tyres, rims and balancing methods of a tractor

12 **2 Hours**

EXPERIMENT 12

Problems on centre of gravity and mechanics of tractors

13 **2 Hours**

EXPERIMENT 13

Field performance evaluation of tractor draw bar

14 **2 Hours**

EXPERIMENT 14

Visit to tractor manufacturing companies

15 **2 Hours**

EXPERIMENT 15

Visit to a power tiller/earth moving machinery industry

Total: 30 Hours

15AG509 TECHNICAL SEMINAR I 0 0 2 1

Course Objectives

- Acquire knowledge about the current technology

- Develop the communication and presentation skills
- Enhance the intellectual discovery and unravel the complexities of thought

Programme Outcomes (POs)

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

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

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		3	2						1		1	
2		3		-					2		1	
3				2	3				1		1	
4				3	2				1		1	
5									2	3	1	1

Total: 0 Hours

15AG510 MINI PROJECT III **0 0 2 1**

Course Objectives

- Improve the analyzing capability of the students
- Increase the exuberance in finding the solution to various problems

Programme Outcomes (POs)

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		3	2			2	1							
2	2	2	1	2		2					2	2		
3			3	2	2			2			2	2		
4		1		2	3	1	2	2						
5									3	3		2		

Total: 0 Hours

15GE511 LIFE SKILLS: APTITUDE I 0 0 2 0

Course Objectives

- To expose the undergraduate students to such methods and practices that help, develop and nurture qualities such as character, effective communication, aptitude and holding ethical values.

Programme Outcomes (POs)

Course Outcomes (COs)

1. Distinguish the pattern of coding and decoding.
2. Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions
3. Evaluate critically the real life situations by resorting and analyzing analytical reasoning of key issues and factors
4. Calculate the percentages and averages

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1												
2												
3												
4												

1 **3 Hours**

CODING AND DECODING

Introduction - Description of Coding method - Coding patterns - Concepts of Coding and Decoding - Problems involving Coding and Decoding methods

2 **3 Hours**

SEQUENCE AND SERIES

Introduction - Sequences of real numbers - Number and Alphabet series - Description of Number and Alphabet series - Analogy - Odd man out- Power series

3 **3 Hours**

DATA SUFFICIENCY

Introduction to Data Sufficiency - Overview of the wide variety of Data Sufficiency problems - Basic introduction on how to determine what information is sufficient to solve a given problem - Common pitfalls to avoid

4 **3 Hours**

DIRECTION

Introduction to Direction - sense test - Overview of the wide variety of Direction problems -Direction - Plotting diagrams

5 **3 Hours**

PROBLEM ON AGES

Introduction- basic concept - usage of percentage and averages- applications

6 **3 Hours**

ANALYTICAL REASONING

Introduction - basic concept - non verbal analytical reasoning - arrangements

7 **3 Hours**

BLOOD RELATION

Introduction - Basic concept - Kinds of relation - Tree diagram - Relations

8 **3 Hours**

BLOOD RELATION

Introduction -Basic concept - Kinds of relation - Tree diagram - Relations

9 **3 Hours**

VISUAL REASONING

Introduction - Basic concepts - Odd man out - Next series - Mirror image and water image

10 **3 Hours**

SIMPLIFICATIONS

Introduction - Basic concepts - Arithmetic operations -Equation solving methods - Puzzles

Total: 30 Hours

Reference(s)

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. Dr.R S Aggarwal, Quantitative Aptitude, Seventh Revised Edition, S.Chand Publishing Company Ltd, 2013.
4. Edgar Thorpe , Course In Mental Ability And Quantitative Aptitude For Competitive Examinations, Third Edition, Tata McGraw-Hill Publishing Company Ltd, 2013.
5. Arun Sharma, How to prepare for Quantitative Aptitude for the CAT, Fifth Edition, Tata McGraw-Hill Publishing Company Ltd, 2013

15AG601 TRANSFER OF TECHNOLOGY 2 0 0 2

Course Objectives

- To familiarize with proper communication techniques
- To expose the students to different extension teaching methods
- Utilizing all the electronic media for transfer of technology

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Able to Communicate in proper ways
2. classify the various extension teaching methods and communication gadgets
3. Determine the use of electronic media for transfer of technology
4. outline of Strengthen to build experiential learning
5. Trained to able to participate in all extension activities

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1	1	1		1	2		2	3		1
2				1			2		3	2		1
3	1			1	3	2			3			2
4				1	2	1		2		3		1
5				1	2		-		2	3		2

UNIT I **6 Hours**

COMMUNICATION

Communication, meaning, definition, types; Communication models; elements and their characteristics; Barriers in communication.

UNIT II **6 Hours**

EXTENSION TEACHING METHODS

Extension teaching methods, meaning, definition, functions, classification (individual, group, mass contact methods), merits and demerits; Audio aids, Visual aids and Audio Visual aids, definition, classification, purpose, planning, selection, combination, use; Training, definition, types, training functions of FTC, KVK, EEI, MANAGE, NAARM.

UNIT III **6 Hours**

E-EXTENSION

e-Extension, Community Radio, Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact disk (IMCD), Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC, consultancy clinics, Geographical Information System (GIS); Agricultural journalism (Print media), definition, principles, importance, ABC of news, types of news.

UNIT IV **6 Hours**

EXPERIENTIAL LEARNING, SYSTEMS THINKING

Experiential Learning (EL), concept, three types of learning, KolbÃ¢??s Cycle; Systems Thinking: concept, importance, Hard System vs. Soft System, Four World Views; Modelling the Farm System: production system, human activity system, marketing system, natural resource system, management system, Supra systems.

UNIT V **6 Hours**

PARTICIPATORY EXTENSION, DIFFUSION OF INNOVATIONS

Participatory Extension Approaches: RRA, PRA; Diffusion of Innovations: definition, elements; Innovation: definition, attributes; Adoption: meaning, steps in adoption process, adopter categories, factors influencing adoption of innovations; Consequences of innovations.

FOR FURTHER READING

The Challenger case study: Bhopal Gas Tragedy: The Three Mile Island and Chernobyl case studies: Fundamental Rights, Responsibilities and Duties of Indian Citizens: Sample code of ethics like IETE, ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management.

Total: 30 Hours

Reference(s)

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi, 2014.
2. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.
3. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited, New Delhi, 2006.
4. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey, 2004.
5. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2005.
6. http://www.slideworld.org/slidestag.aspx/human-values-and-professional-ethics

15AG602 CROP PROCESS ENGINEERING 3 0 0 3

Course Objectives

- To understand better the processing of cereals, pulses, oil seeds and horticultural crops
- To know the physical and thermal properties of grains
- To understand in-depth knowledge on the theory, methods, and equipment for the various unit operations of crop processing

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Possess better exposure to the different engineering properties of biological materials and their importance
2. Recognize the working principles of grain cleaning and grading devices and able to select suitable equipment for cereal grains, oilseeds, and pulses
3. Identify conveying and storage systems used for agricultural products and apply knowledge on properties of product to identify systems for the better processing
4. Apply the knowledge on the various properties of the cereals, pulses, and oil seeds for processing
5. Identify post-harvest operations for horticultural crops utilize the skills on post- harvest machines to increase the market value of the processed food products

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	2	1	2						
2	2	3	2	2	2	1	1					
3	2	3	3	2	1	1						
4	2	2	3	2	1	1	1					1
5	2	1	3	2	2	1	1					1

UNIT I **8 Hours**

INTRODUCTION

Post harvest engineering: introduction, objectives, post harvest losses of cereals, pulses and oilseeds, importance, optimum stage of harvest. Threshing: traditional methods, mechanical threshers: types, principles and operation. Engineering properties of food materials, moisture content measurement: direct and indirect methods, moisture meters, equilibrium moisture content.

UNIT II **10 Hours**

CLEANING, GRADING AND DRYING

Principles, air screen cleaners: types, adjustments. Cylinder separator, spiral separator, magnetic separator, colour sorter, inclined belt separator, length separators, effectiveness of separation and performance index. Different types of graders for cereals, pulses and oil seed crops. 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 **9 Hours**

MATERIAL HANDLING AND STORAGE

Material handling: belt conveyor, screw conveyor, chain conveyor, bucket elevators, pneumatic conveying. Direct and indirect types of damages, sources of infestation, traditional and modern types of storage structures: vertical, horizontal and underground storage, storage structure designs.

UNIT IV **9 Hours**

PROCESSING OF CEREALS, PULSES AND OILSEEDS

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, performance evaluation of modern mills. Wheat milling, pulse milling methods. Oil seed processing. Sugarcane crushing, extraction recovery and processing of jaggery. Principles and operation: maize sheller, husker sheller for maize, groundnut decorticator, castor sheller.

UNIT V **9 Hours**

PROCESSING OF FRUITS AND VEGETABLES

Physical and thermal properties of fruits and vegetables, maturity indices for fruits, cleaning and grading of fruits and vegetables. Electronic colour sorting of fruits and vegetables. Unit operation of fruit processing:

blanching of fruits and vegetables, thermal processing of fruit pulps. Controlled and Modified atmospheric storage and shrink film storage of fruits and vegetables.

FOR FURTHER READING

Project preparation, Solar drying of grains, agro processing industries, project preparation

1 **2 Hours**

EXPERIMENT 1

Study on physical and chemical properties of biomass

2 **2 Hours**

EXPERIMENT 2

Design of KVIC model biogas plant and Deenbandhu model biogas plant

3 **2 Hours**

EXPERIMENT 3

Study on purification of biogas - CO2 and H2S removal

4 **2 Hours**

EXPERIMENT 4

Evaluation of thermal efficiency of biogas stove

5 **2 Hours**

EXPERIMENT 5

Performance evaluation of biogas run dual fuel diesel engine

6 **2 Hours**

EXPERIMENT 6

Estimation of manurial value of biodigested slurry

7 **2 Hours**

EXPERIMENT 7

Design of UASB reactor

8 **2 Hours**

EXPERIMENT 8

Determination of BOD of a liquid effluent

9 **2 Hours**

EXPERIMENT 9

Determination of COD of a liquid effluent

10 **2 Hours**

EXPERIMENT 10

Study on briquetting and calculation of stoichiometric air requirement of biomass

11 **2 Hours**

EXPERIMENT 11

Determination of thermal efficiency of wood burning stoves

12 **2 Hours**

EXPERIMENT 12

Performance evaluation of agro residue gasifier

13 **2 Hours**

EXPERIMENT 13

Study of producer gas run IC engine

14 **2 Hours**

EXPERIMENT 14

Study on pyrolysis plant and waste heat recovery calculation

15 **2 Hours**

EXPERIMENT 15

Visit to biomass based power plant

Total: 75 Hours

Text Book(s)

1. P.K. Srivastava, B.D. Shukla and T.P. Ojha, Technology and application of biogas, Jain Brothers, New Delhi, 1993

Reference(s)

1. N.N. Mohsenin, Physical Properties Of Plant And Animal Materials, Gordon and Breach publishers, New York, 1986
2. K.M.Sahay and K.K. Singh.Unit Operations of Agricultural Processing, Vikas Publication House Pvt. Ltd.,2012
3. A.Chakraverty. Post Harvest Technology of Cereals,Pulses and Oil Seeds.Oxford and IBH Publing Co. Pvt.Ltd.,2012
4. W.L. McCabe and J.C. Smith, Unit Operations in Chemical Engineering, McGraw Hill Kogakusha Ltd, Tokyo, 2001
5. A.N. Mathur and N.S. Rathore, Biogas production Management and Utilisation, Himanshu Publications, New Delhi, 1993

15AG603 DESIGN OF AGRICULTURAL MACHINERY 3 0 0 3

Course Objectives

- To learn design considerations and their applications in agricultural tractors and typical machines
- To understand the standards and procedures for designing of primary and secondary tillage implements
- To understand the standards and procedures for calibration of seed drill, planter and tractor safety measures

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Predict the knowledge on design considerations of farm machinery
2. Asses the knowledge on design and construction of primary tillage implements
3. Carryout the design and construction of secondary tillage implements
4. Recognize the working principles of seed drill and planters
5. compute the knowledge on tractor safety measures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	2	2	2	1	1	1	1	-		
2	2	2	3	1	2	1	1	1	-	-		
3	2	3	3	1	2	1	1	1	-			

4	2	3	3	1	2	1	1	1				
5	2	3	3	1	2	1	1			-		2

UNIT I **9 Hours**

INTRODUCTION

Modern trends, principles, procedures, fundamentals and economic considerations for design and development of farm power and machinery systems. Design considerations, procedure and their applications in agricultural tractors & typical machines. Reliability criteria in design and its application.

UNIT II **9 Hours**

CONSTRUCTION OF PRIMARY TILLAGE IMPLEMENTS

Design of coulters, shares, mould boards. Construction of mould board working surface. Design of landside, frog, jointer. Forces acting on plough bottom and their effect on plough balance, trailed, semi mounted and mounted plough. Draft on ploughs, resistance during ploughing. Design disk ploughs, concave disk working tools, forces acting on disc ploughs.

UNIT III **9 Hours**

CONSTRUCTION OF SECONDARY TILLAGE IMPLEMENTS

Machines and implements for surface and inter row tillage, peg toothed harrow, disk harrows, rotary hoes, graders, rollers, cultivators, design of V shaped sweeps, rigidity of working tools. Rotary machines, trajectory of motion of rotary tiller tynes, forces acting, power requirement. Machines with working tools executing an oscillatory motion.

UNIT IV **9 Hours**

CALIBRATION OF SEED DRILL/PLANTER

Methods of sowing and planting, machines, agronomic specifications. Sowing inter-tilled crop. Grain hoppers, seed metering mechanism, furrow openers and seed tubes. Planting and transplanting, paddy transplanters, potato planters. Machines for fertilizer application, discs type broadcasters. Organic fertilizer application, properties of organic manure, spreading machines. Liquid fertilizer distributors.

UNIT V **9 Hours**

TRACTOR SAFETY MEASURES

Safety devices for tractors & farm implements. Cabs & HVAC designs- designs of ROPS & FOPS, seat belts and helmets. Safety locations of PTO, belt pulley and hitch linkages and shield Ã¢?? safe tractor operation-maintenance inspection for safety.

FOR FURTHER READING

Design of power screws, Lubrication theory, Static and Dynamic loadings.

1 **2 Hours**

EXPERIMENT 1

Performance evaluation of potato harvester

2 **2 Hours**

EXPERIMENT 2

Performance evaluation of tapioca harvester

3 **2 Hours**

EXPERIMENT 3

Performance evaluation of paddy harvester - operational adjustments, maintenance and safety aspects

4 **2 Hours**

EXPERIMENT 4

Performance evaluation of a power operated paddy thresher

5 **2 Hours**

EXPERIMENT 5

Performance evaluation of Digging holes with power tiller operated digger

6 **2 Hours**

EXPERIMENT 6

Performance evaluation of a power operated chaff cutter

7 **2 Hours**

EXPERIMENT 7

Study of operation of sugarcane planter and harvester

8 **2 Hours**

EXPERIMENT 8

Study of Operation of multicrop threshers

9 **2 Hours**

EXPERIMENT 9

Vertical conveyor reaper - operation - performance evaluation

10 **2 Hours**

EXPERIMENT 10

Evaluation of husker sheller for maize

11 **2 Hours**

EXPERIMENT 11

Study on working of mower and reapers

12 **2 Hours**

EXPERIMENT 12

Study on working of different systems of a combine harvesters and their evaluation

13 **2 Hours**

EXPERIMENT 13

Visit to farm implements manufacturing company

14 **2 Hours**

EXPERIMENT 14

Evaluation of a groundnut thresher

15 **2 Hours**

EXPERIMENT 15

Evaluation of fruit harvesters

Total: 75 Hours

Reference(s)

1. V. B. Bhandari, Design of Machine Elements, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2010
2. Faculty of Mechanical Engineering, PSG College of Technology, Design Data Book, M/s.Kalaikathir Achchagam, 2013
3. J. E. Shigley and C. R. Mischke, Mechanical Engineering Design, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2011
4. R. C. Juvinall and K. M. Marshek, Fundamentals of Machine Component Design, John Wiley & Sons, New Delhi, 2011
5. R. L. Norton, Design of Machinery, Tata McGraw-Hill Publishing Company Pvt Ltd., New Delhi, 2004
6. W. Orthwein, Machine Component Design, Jaico Publishing Co, 2013

2 2 0 3

15AG604 DESIGN OF MICRO IRRIGATION SYSTEMS

Course Objectives

- To understand the basic concepts, tools, and skills used to deliver water efficiently and effectively on both a field and garden scale
- To learn about the role of irrigation water in agriculture, and the environmental factors that influence the type, frequency, and duration of irrigation
- To learn about the resources and essential skills needed to determine the proper timing and volume of irrigation, using both qualitative and quantitative methods

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Categorize the different types of pumps and water lifting devices based on the principle, components, and working efficiency
2. Explain the working principle of centrifugal pump as well as its characteristics with efficiencies and design the centrifugal pump including impeller design, casing and other parts of pumps
3. Estimate water budgets and hydraulics used to develop irrigation schedules through micro irrigation based on crop geometry
4. Design drip and sprinkler irrigation system including, main line, sub main and laterals designs by consider pump capacity
5. Design green house irrigation system and advanced types of irrigation including lift irrigation and automation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2	3	2	2	1	1			-		1

2	2	2	3	2	2	1	1			-		1
3	2	2	3	2	2	1	1		-			1
4	2	2	3	2	2	1	1					1
5	2	2	3	2	2	1	1					1

UNIT I **6 Hours**

TYPES OF PUMPS AND OTHER WATER LIFTING DEVICES

Indigenous water lifts, types and their working. Types of pumps: Positive displacement and variable displacement pumps. Reciprocating pump, principle, components, single acting and double acting, work done, coefficient of discharge, slip.

UNIT II **6 Hours**

CENTRIFUGAL, SUBMERSIBLE AND TURBINE PUMPS

Centrifugal pump: classification, principle and working, fundamental equations of centrifugal pumps, ideal, virtual and manometric heads of centrifugal pumps, net positive suction head, work done by centrifugal pump. Pump characteristics and efficiencies, priming and cavitation in centrifugal pumps, multistage centrifugal pumps. Design of impellers and casing, selection of centrifugal pumps. Submersible, Turbine pumps, Mixed flow, Axial flow, jet and Airlift pumps. Pump selection and installation, pump troubles and remedies

UNIT III **6 Hours**

WATER BUDGETING AND DRIP IRRIGATION

Micro irrigation: classification, Irrigation scheduling, Water Budgeting with microirrigation. Hydraulics of micro irrigation, components. Valves, planning factors. Wetting pattern, crop geometries.

UNIT IV **6 Hours**

DRIP AND SPRINKLER IRRIGATION DESIGN

Sprinkler irrigation, components, performance. Uniformity and efficiency of sprinkler systems, sprinkler discharge. Distance of throw. Distribution pattern, application rate. Droplet size. Sprinkler selection and spacing, capacity of sprinkler system. Design of laterals, tapered. Design of Main lines, pump capacity. Operation and maintenance of sprinkler irrigation system.

UNIT V **6 Hours**

SPECIAL TYPES OF IRRIGATION

Greenhouse irrigation system, design. Lift irrigation system: Design, subsurface drip irrigation. Soil less culture, Fertigation, Automation.

FOR FURTHER READING

Project preparations: Design and draw the layout of a drip/sprinkler irrigation system for 10 acres, preparation of project proposal for the installation and commissioning of irrigation systems

Total: 60 Hours

Reference(s)

1. V.Ravikumar and M.V.Ranghaswami, Micro irrigation and irrigation pumps. Kalyani Publishers, Ludhiana. 2011
2. A.M.Michael, Irrigation Ã*f*?Ã‚¢?? theory and practice, Vikas publishers, New Delhi, 2010
3. Jack Keller and Rond Belisher, Sprinkler and Trickle irrigation, Van Nostrand Reinhold, New York, 1990
4. I.J. Kavassik, Engineers Guide to Centrifugal pumps, McGraw Hill Book Company, 1964
5. L.J. James, Farm Irrigation System Design, John Wiley & Sons, 1988

15AG607 CROP PROCESS ENGINEERING LABORATORY

0 0 2 1

Course Objectives

- To understand better the processing of cereals, pulses, oil seeds and horticultural crops
- To know the physical and thermal properties of grains
- To understand in-depth knowledge on the theory, methods, and equipment for the various unit operations of crop processing

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Determine the different engineering properties of biological materials and their importance
2. Design different post harvest equipments for cereals and oil seeds
3. Determine the efficiency of various grain cleaning and milling equipments

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	2	2	1	1	1		-	-		1
2	3	2	2	2	1	1			-	-		1
3	3	2	2	2	1	1	-		-			1

1 **2 Hours**

EXPERIMENT 1

Determination of moisture content of grains, potato slice by oven-dry method and draw the drying characteristic curves

2 **2 Hours**

EXPERIMENT 2

Determination of size, true density, bulk density and porosity of grains

3 **2 Hours**

EXPERIMENT 3

Determination of coefficient of friction internal and external for different grains

4 **2 Hours**

EXPERIMENT 4

Determination of angle of repose of different grains

5 **2 Hours**

EXPERIMENT 5

Determination of milling quality of different grains

6 **3 Hours**

EXPERIMENT 6

Determination of shelling efficiency of groundnut decorticator

7 **2 Hours**

EXPERIMENT 7

Evaluation of thermal efficiency and heat utilization factor in a grain drier

8 **2 Hours**

EXPERIMENT 8

Determination of drying characteristics of grains

9 **2 Hours**

EXPERIMENT 9

Visit to a processing industry to study bucket elevator and screw conveyor

10 **2 Hours**

EXPERIMENT 10

Performance evaluation of paddy parboiling drum

11 **2 Hours**

EXPERIMENT 11

Evaluation of efficiency of a grain cleaning cum grading machine

12 **2 Hours**

EXPERIMENT 12

Evaluation of shelling efficiency of rubber roll sheller and cone polisher

13 **2 Hours**

EXPERIMENT 13

Determining the oil content of oil seeds using Soxhlet apparatus

14 **2 Hours**

EXPERIMENT 14

Determination of drying characteristics of fruits and vegetables

15 **2 Hours**

EXPERIMENT 15

Visit to modern rice mill/ pulse/ oil milling industries

Total: 31 Hours

0 0 2 1

15AG608 COMPUTER AIDED MODELING LABORATORY

Course Objectives

- To impart training to draw orthographic views of machine components using CAD Modelling Software
- To develop the skill to create three dimensional models from orthographic views using CAD Modelling Software
- To create three dimensional assembly models and their animation using standard CAD packages

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Draw two dimensional drawings of engineering components using standard CAD Modelling package
2. Develop a three dimensional assembly model consisting of many components with tolerances.
3. Generate animations from three dimensional assembly models by applying various motion constraints.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	-	2	-	1							
2	2	2	-	3	1							
3	1	1	-		-							

1 **2 Hours**

EXPERIMENT 1

Introduction to modeling software:Practicing sketching, Dimensioning and Modelling Tools and Creating simple 3D models by using any CAD Modelling Software

2 **4 Hours**

EXPERIMENT 2

Create a orthographic views of machine components from isometric component drawing

3 **2 Hours**

EXPERIMENT 3

Create a two dimensional sketch diagrams of simple machine components

4 **4 Hours**

EXPERIMENT 4

Create a three dimensional assembly model of bearing from detailed orthographic drawings

5 **2 Hours**

EXPERIMENT 5

Create a three dimensional assembly model of coupling from detailed orthographic drawings

6 **4 Hours**

EXPERIMENT 6

Create a three dimensional assembly model of I C Engine components from detailed orthographic drawings

7 **2 Hours**

EXPERIMENT 7

Create a three dimensional assembly model of gear box from detailed orthographic drawings

8 **2 Hours**

EXPERIMENT 8

Create a three dimensional assembly model of two wheeler suspension system from detailed orthographic drawings

9 **2 Hours**

EXPERIMENT 9

Create a three dimensional assembly model of valves from detailed orthographic drawings

10 **4 Hours**

EXPERIMENT 10

Create a three dimensional assembly model of simple mechanism and animate its working in modeling software

11 **2 Hours**

EXPERIMENT 11

Create a three dimensional assembly model of simple energy conversion/power transmission system and animate its working using modeling software

Total: 30 Hours

15AG609 TECHNICAL SEMINAR II 0 0 2 1

Course Objectives

- Acquire knowledge about the current technology
- Develop the communication and presentation skills

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Refer and utilize various technical resources available from multiple fields
2. Improve the technical presentation and communication skills
3. Analyze the importance of intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds
4. Interact and share their technical knowledge to enhance the leadership skills
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	3		-	-				-	2		-
2	1			-					-	3	-	-
3	1	2	-	-					-	3		-
4	1	2		-					-	3		2

5		-	-	-					-	3	2	1

Total: 0 Hours

15AG610 MINI PROJECT IV **0 0 2 1**

Course Objectives

- Speculate the problem identifying ability
- Improve the analyzing capability of the students

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	3	2	-				-	-	-	
2	2	3	1	2					-	-		-
3	2	1		-	3				-		-	-
4	2	1	2	3	-	-			-	-		-

5	1	-	1	-		-			2	3		-

Total: 0 Hours

0 0 2 0

15GE611 LIFE SKILLS: APTITUDE II

Course Objectives

- The undergraduate students to such methods and practices that help, develop and nurture qualities such as character, effective communication, aptitude and holding ethical values

Programme Outcomes (POs)
Course Outcomes (COs)

1. Perform arithmetical operations with complex numbers
2. Explain the meanings of a relation defined on a set, an equivalent relation and a partition of a set
3. Calculate percentages in real life contexts , find any percentage of a given whole using their knowledge of fraction multiplication and increase / decrease a given whole by a percentage
4. Demonstrate the situations like motion in as straight line,Boats and Streams, Trains, Races and clocks
5. Evaluate the Counting techniques, Permutation and Combination, Recursion and generating functions

UNIT 1 **3 Hours**

NUMBER SYSTEMS

Introduction - definition- classification on Numbers -power cycles and remainders - short cut process - concept of highest common factor - concept of least common multiple - divisibility - number of zeros in an expression

UNIT 2 **3 Hours**

PERCENTAGES

Introduction - definition and Utility of percentage - importance of base/denominator for percentage calculations - concept of percentage values through additions - fraction to percentage conversion table

UNIT 3 **3 Hours**

AVERAGES

Introduction - average of different groups - addition or removal of items and change in average- replacement of some of the items

UNIT 4 **3 Hours**

RATIO, PROPORTIONS AND VARIATION

Introduction- Ratio- properties-dividing a given number in the given ratio - comparison of ratios - proportions - useful results on proportion- continued proportion - relation among the quantities more than two - variation

UNIT 5 **3 Hours**

PROFIT AND LOSS

Gain/Loss and percentage gain or percentage loss-multiplying equivalents to find sale price - relation among cost price, sale price, gain/loss and percentage gain or percentage loss - an article sold at two different selling price - two different articles sold at same selling price - percentage gain or percentage loss on selling price - percentage gain or percentage loss on whole property

UNIT 6 **3 Hours**

TIME AND WORK

Introduction - Basic concepts -Concepts on working with different efficiency - Pipes and Cisterns - Work Equivalence (Man Days) -Alternative approach

UNIT 7 **3 Hours**

TIME, SPEED AND DISTANCE

Definition - Basics of Time, Speed and Distance - Relative speed - Problems based on Trains? Problems based on Boats and Streams -Problems based on Races - time taken with two difference modes of transport - time and distance between two moving bodies

UNIT 8 **3 Hours**

PERMUTATION AND COMBINATION

Definition - Fundamental rules - Theorems on Permutation - Theorems on Combination

UNIT 9 **3 Hours**

PROBABILITY

Concept and importance of probability - underlying factors for Real- Life estimation of probability - Basic facts about probability - some important consideration while defining event.

UNIT 10 **3 Hours**

MIXTURES AND ALLIGATION

Definition - alligation rule - mean value (cost price) of the mixture - some typical situations where allegation can be used.

Total: 30 Hours

Reference(s)

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
3. Dr.R S Aggarwal, Quantitative Aptitude, Seventh Revised Edition, S.Chand Publishing Company Ltd, 2013.
4. Edgar Thorpe , Course In Mental Ability And Quantitative Aptitude For Competitive Examinations, Third Edition, Tata McGraw-Hill Publishing Company Ltd, 2013
5. Arun Sharma, How to prepare for Quantitative Aptitude for the CAT, Fifth Edition, Tata McGraw-Hill Publishing Company Ltd, 2013

15AG701 AGRICULTURAL ECONOMICS 3 0 0 3

Course Objectives

- Provide the theoretical foundations in micro and macro analysis in terms of concepts and theories
- Emphasis the systematic evaluation of the costs and benefits associated with projects
- Enumerate the idea of Balance sheet and Balance of payments

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Understand the micro economic environment for creating a favorable business environment
2. Take decision by making use of the major concepts and techniques of engineering economic analysis
3. Compare the cost of multiple projects by using the methods learned, and make a quantitative decision between alternate facilities and/or systems
4. Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio
5. Examine and evaluate the issues in macro-economic analysis

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1				-	-	-	2		3	
2	3			-					2		3	
3	2	1		-					2	-	3	
4	-	1				1		1			3	-
5	-	2				-		1	-		3	

UNIT I **9 Hours**

INTRODUCTION

Introduction to Micro and Macro economics - Kinds of Economic Systems - Production Possibility Frontier - Opportunity Cost - Objective of Organizations - Kinds of Organization

UNIT II **9 Hours**

DEMAND AND SUPPLY

Functions of Demand and Supply - Law of diminishing Marginal Utility - Law of Demand and Supply - Elasticity of Demand - Demand Forecasting Methods - Indifference curve

UNIT III **9 Hours**

PRODUCTION AND COST

Production Function - Returns to Scale - Law of Variable Proportion - Cost and Revenue concepts and Cost Curves - Revenue curves - Economies and Diseconomies of scale - Break Even point

UNIT IV **9 Hours**

MARKET STRUCTURE

Market Structure - Perfect Competition - Monopoly - Monopolistic - Oligopoly - Components of Pricing - Methods of Pricing - Capital Budgeting IRR - ARR - NPV - Return on Investment - Payback Period

UNIT V **9 Hours**

INTRODUCTION TO MACRO ECONOMICS AND FINANCIAL ACCOUNTING

National Income - Calculation Methods - Problems - Inflation - Deflation - Business Cycle - Taxes - Direct and Indirect Taxes - Fiscal and monetary policies- Commodity/ Share market

FOR FURTHER READING

Nature and characteristics of Indian Economy - Role and functions of Central bank - LPG - GATT - WTO

Total: 45 Hours

Reference(s)

1. A Ramachandra Aryasri and V V Ramana Murthy, Engineering Economics and Financial Accounting, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006
2. V L Samuel Paul and G S Gupta, Managerial Economics Concepts and Cases, Tata McGraw Hill Publishing Company Limited, New Delhi, 1981
3. R Kesavan, C Elanchezhian and T Sunder Selwyn, Engineering Economics and Financial Accounting, Laxmi Publication (P) Ltd, New Delhi, 2005.
4. S N Maheswari, Financial and Management Accounting, Sultan Chand
5. V L Samuel Paul and G S Gupta, Managerial Economics-Concepts and Cases

15AG702 FOOD AND DAIRY ENGINEERING 3 0 0 3

Course Objectives

- To acquire better understanding of the food concentration and thermal processing of foods
- To know the physical and thermal properties of milk and different methods of milk processing and milk products
- To gain knowledge on the theory, methods, and equipment for the various unit operations of dairy industry

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Explain physical, mechanical, thermal, rheological and electrical properties of food material and appraise their importance in food processing
2. Distinguish various thermal treatment techniques for food products and select suitable thermal processing method for food products based on their properties
3. Compare food drying systems and assess their limitations in applying different food products
4. Explain physical, chemical and thermal properties of milk and compare milk processing techniques
5. Design various milk processing equipment and evaluate their performance

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	2	1	1	-			-		1	-

2	2	1	3	2	1	1			-	-		-
3	1	2	3	2	1				-	-	1	-
4	3	1	1	1	1	1			-			-
5	1	2	1	1	1					-	1	-

UNIT I **8 Hours**

BASIC PROPERTIES OF FOOD MATERIALS

Constituents of food and their energy values - Physical, mechanical, thermal, rheological, electrical and physico-chemical properties of food materials- texture of food materials - definition - Terminologies - viscometry - basic concepts - Concentrations of foods - freeze concentration - membrane concentration

UNIT II **12 Hours**

THERMAL PROCESSING OF FOODS

Thermal processing of foods - product-time-temperature relationships - cooking, blanching- pasteurization techniques- UHT Processing - sterilization of solid and liquid foods- interaction of heat energy on food components - kinetics of microbial destruction - Decimal reduction time -Temperature dependence of kinetics - Arrhenius equation - Thermal Death Time Curves-loss of nutrient in Newtonian and non-Newtonian liquid foods-batch and continuous sterilization equipment. Preservation by retort processing - principles and applications - microwave and radio frequency heating in food processing- Canning- Aseptic packaging

UNIT III **9 Hours**

DRYING AND DEHYDRATION

Food spoilage - causes for spoilage -Moisture content - free moisture - bound and unbound moisture-equilibrium moisture content - Water activity - sorption behaviour of foods - types of dryers - drum, spray, dryers-advantages and disadvantages - dehydration - methods of dehydration osmotic dehydration - microwave drying- foam mat drying of materials-freeze drying, Heat pump dryer, Hybrid dryer

UNIT IV **6 Hours**

NILK PROCESSING

Physical, chemical, thermal and rheological properties of milk - storage tanks. Receiving handling and testing of milk - storage. Pasteurization - application- equipment - Low Temperature Long Time - High Temperature Short Time - Ultra High Temperature pasteurization

UNIT V **10 Hours**

DAIRY EQUIPMENT AND PRODUCTS

Homogenisation - theory and working of homogenisers - high pressure homogenization of milk and other food suspensions - design criteria for homogenizing equipment- cream separation - principles - types of separators. Clarifiers - butter churns - ghee manufacture - equipment - whey manufacture - techniques - equipment - ice cream freezers - condensed milk - milk powder manufacturing - drying equipment - spray drier - milk products - paneer - casein - probiotic dairy products - kefir- milk plant sanitation requirements - Cleaning in-place and its functions

FOR FURTHER READING

Waste utilisation and energy conservation in dairy industry - Utilisation of whey for energy generation through biomethanation, energy conservation opportunities in dairy industry and packaging of dry products

Total: 45 Hours

Text Book(s)

1. R.M. Teledo" Fundamentals of Food Process Engineering", 2nd Ed. Van Nostrand Reinhold,New York, 1991
2. C.W. Hall and T.J. Hedrick, Drying of milk and milk products, AVI Publishing Co., West Port, Connecticut, USA, 1971

Reference(s)

1. R.Paul Singh and R.Dennis Heldman, Introduction to Food Engineering.4th Edition, Academic Press, London, 2008
2. Gordon L. Robertson, Food Packaging- Principles and Practice Marcel Dekker Inc, USA, 1993
3. Norman N. Potter and Joseph H. Hotchkiss, Food Science, Fifth Edition, Food Science Text Series, 3. ISBN: 978-1-4613-7263-9 (Print) 978-1-4615-4985-7 (Online), 1995
4. Sukumar De, Outlines of Dairy: Technology, Oxford University Press, 2001

15AG703 RENEWABLE ENERGY RESOURCES 3 0 2 4

Course Objectives

- To acquire knowledge about the fundamentals of renewable energy resources.
- To understand the concepts and conversion systems in harnessing.
- To apply the above concepts in meeting the energy needs in farm

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Know about the energy scenario and status of renewable energy sources and production in India
2. Possess the knowledge on thermal conversion technologies
3. Possess the knowledge on biochemical conversion technology and biofuels
4. Able to use solar energy conversion system (secs) and wind energy conversion system (wecs) to meet the energy requirements of farms
5. Possess the knowledge on hydro and ocean energy conversion system and energy auditing

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	-	-	-	3	1	2					
2	1	3	-	2	2	-	2					
3	1	2	3	1	1	-	1					
4	1	3	2	2	1		2					
5	1	2	3	1	1		2					

UNIT I **9 Hours**

OVERVIEW OF RENEWABLE ENERGY SOURCES

Classification of energy sources, Renewable Energy-Potentials and Achievements.Characterization of biomass, Densification of biomass - Briqquetting.

UNIT II **9 Hours**

THERMOCHEMICAL CONVERSION TECHNOLOGY (TCCT)

Biomass Combustion Technology, Gasifiers Technology, Biomass Gasification Methods, Removal of tar and impurities from gasification, Principles of pyrolysis and methods.

UNIT III **9 Hours**

BIOCHEMICAL CONVERSION TECHNOLOGY-BIOGAS (BCCT) AND BIO FUELS

Importance of biofuels, Biogas technology, Biogas plants types, Microbiology of biogas production, Size and selection for Biogas plant, Biogas plant- materials and methods for Construction. Bio-Fuels and characteristics, Bio-Diesel, Bio-Diesel production processes, Bio-Ethanol Production, BEA, running of biofuel engines.

UNIT IV **9 Hours**

SOLAR ENERGY CONVERSION SYSTEM (SECS) AND WIND ENERGY CONVERSION SYSTEM (WECS)

Basics of Solar Photovoltaics, Recent trends in solar drying-solar tunnel drier, Solar Driers, Solar PV and water pumping, Solar Water Heater. Wind energy conversion principles, Wind mill- aero generator, Wind mill- water pumping.

UNIT V **9 Hours**

HYDRO AND OCEAN ENERGY CONVERSION SYSTEM AND ENERGY AUDITING

Hydropower Energy Sources. Hydropower types sustainabiity. Ocean Energy conversion systems,Ocean Thermal Energy Conversion (OTEC) system- thermodynamic efficiency- cycle types- environmental effect-technical difficulties. Energy Auditing- carbon foot print. Clean development mechanism

FOR FURTHER READING
Energy Auditing and Management.

1 **2 Hours**
EXPERIMENT 1
Problems on solar time, basic earth sun angles

2 **2 Hours**
EXPERIMENT 2
Study of radiation measuring instruments - Visit to meteorology station

3 **2 Hours**
EXPERIMENT 3
Solving problems on thermal losses and efficiency of flat plate collectors

4 **2 Hours**
EXPERIMENT 4
Determination of thermal efficiency of solar water heater

5 **2 Hours**
EXPERIMENT 5
Determination of thermal efficiency of natural convection solar dryer

6 **2 Hours**
EXPERIMENT 6
Determination of thermal efficiency of forced convection solar dryer

7 **2 Hours**
EXPERIMENT 7
Determination of thermal efficiency of solar still

8 **2 Hours**
EXPERIMENT 8
Study of photovoltaic cell characteristics

9 **2 Hours**
EXPERIMENT 9
Study on the performance of wind generator in the lab

10 **2 Hours**
EXPERIMENT 10
Performance evaluation of a SPV water pumping system

11 **2 Hours**
EXPERIMENT 11
Wind Energy conversion calculations for power generation

12 **2 Hours**
EXPERIMENT 12
Design of rotor blade for horizontal axis wind mill

13 **2 Hours**

EXPERIMENT 13

Study of wind measuring instruments

14 **2 Hours**

EXPERIMENT 14

Visit to a solar PV power plant

15 **2 Hours**

EXPERIMENT 15

Experiment on duel fuel engine

Total: 75 Hours

Reference(s)

1. H. P. Garg, Treatise on Solar Energy, Vol.1 : Fundamentals of solar energy, John Wiley & sons Ltd, 1982.
2. A.John. Duffie and William A. Beckman, Solar Engineering of Thermal Processes, 4th Edition ISBN: 978-0-470-87366-3, John Wiley and Sons Ltd, 2013
3. J.F.Manwell, J.G. McGswan and A.L.Rogers, Wind Energy Explained. Theory, Design and Application, John Wiley and Sons Ltd, 2004
4. Solanki Chetan Singh, Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice-Hall Of India Pvt. Limited, 2009
5. H.P. Garg, Advances in Solar Energy Technology Volume 2, Industrial Applications of Solar Energy, ISBN: 978-94-010-8188-7 (Print), Springer Publications. 1987.
6. Jui Sheng Hsieh, Solar Energy Engineering, Prentice Hall, London, 1986

15AG704 RS AND GIS FOR NATURAL RESOURCE MANAGEMENT

3 0 2 4

Course Objectives

- To introduce the students to the basic concepts and principles of various components of remote sensing.
- To study the applications of Remote Sensing and GIS in agriculture, soil and water resources
- To understand in-depth the knowledge on the theory,methods, and equipment for the various unit operations of crop processing

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Identify different electromagnetic radiations and evaluate its applications in remote sensing systems and satellite data processing satellite data processing
2. Make use of platform and sensors and compare its applicability in available data products
3. Analyze the Geographic Information System (GIS) images and categorize according to its application
4. Identify components of Geographic Information System (GIS) and select suitable data base management systems (DBMS) and modeling tool
5. Decide on RS &GIS tools to create a strategy on natural resource management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	-	-	3		-	1					1
2	2	-	-	3		-	1					
3	1		2	3	-	-	2					
4	-	-		3	-							
5	-	-	-	3								2

UNIT I **9 Hours**

EMR AND ITS INTERACTION WITH ATMOSPHERE

sensing and its components, Electromagnetic spectrum, wavelength regions important to remote sensing Wave theory, Particle theory, Stefan-Boltzman and Wein s Displacement Law Atmospheric scattering, absorption Atmospheric windows spectral signature concepts typical spectral reflective characteristics of water, vegetation and soil.

UNIT II **9 Hours**

PLATFORMS AND SENSORS

Types of platforms orbit types, Sun-synchronous and Geosynchronous Passive and Active sensors resolution concept Pay load description of important Earth Resources and Meteorological satellites Airborne and space borne TIR and microwave sensors

UNIT III **9 Hours**

IMAGE INTERPRETATION AND ANALYSIS

Types of Data Products, types of image interpretation, basic elements of image interpretation, visual interpretation keys. Digital Image Processing, Pre-processing, image enhancement techniques, multispectral image classification Supervised and unsupervised.

UNIT IV **9 Hours**

GEOGRAPHIC INFORMATION SYSTEM

Introduction Maps, Definitions, Map projections, types of map projections, map analysis. GIS definition, basic components of GIS, standard GIS softwares. Data type, Spatial and non- spatial (attribute) data, measurement scales. Data Base Management Systems (DBMS) Modelling in GIS,Digital Elevation Modelling

UNIT V **9 Hours**

RS AND GIS APPLICATIONS

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, water quality assessment. Application of Remote Sensing and GIS in Precision Agriculture, Monitor Crop Health, Management Decision Support Systems

FOR FURTHER READING

Microwave remote sensing Ã¢?? SAR Technology and their application in Agriculture and Soils, forestry, hydrology and disaster management.

1 **2 Hours**

EXPERIMENT 1

Aerial photo interpretation - visual

2 **4 Hours**

EXPERIMENT 2

Satellite images interpretation - visual

3 **4 Hours**

EXPERIMENT 3

Supervised classification practice

4 **2 Hours**

EXPERIMENT 4

Unsupervised classification practice

5 **2 Hours**

EXPERIMENT 5

Database Management Systems

6 **4 Hours**

EXPERIMENT 6

Spatial data input and editing – Digitising

7 **4 Hours**

EXPERIMENT 7

Raster analysis problems - Database query

8 **2 Hours**

EXPERIMENT 8

GIS applications in DEM and its analysis

9 **2 Hours**

EXPERIMENT 9

GIS application in watershed analysis

10 **4 Hours**

EXPERIMENT 10

GIS application in rainfall-runoff modeling

Total: 75 Hours

Text Book(s)

1. I.A. Wolf, Handbook of Processing and Utilization in Agriculture, (2 vol. set), CRC Press, Florida,1983

Reference(s)

1. M.Anji Reddy, Textbook of Remote Sensing and Geographical Information System, 3rd Edition, BS Publications, 2008
2. Floyd F.Sabins, Remote Sensing: Principles and Interpretation, III edition, Freeman and Company, New York, 1997
3. Ian Heywood, an Introduction to GIS, Pearson Education, New Delhi, 2001
4. P.A. Burrough, Principle of GIS for land resources assessment, Oxford Publications, 1990.
5. Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2000.

15AG707 FOOD AND DAIRY ENGINEERING LABORATORY

0 0 2 1

Course Objectives

- To acquire better understanding of the food concentration, and thermal processing of foods
- To know the physical and thermal properties of milk and different methods of milk processing and milk products
- To gain knowledge on the theory, methods, and equipment for the various unit operations of dairy industry

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Course Outcomes (COs)

1. Explain physical, mechanical, thermal, rheological and electrical properties of food material and appraise their importance in food processing
2. Distinguish thermal treatment techniques for food products and select suitable thermal processing method for food products based on their properties
3. Compare food drying systems and assess their limitations in applying different food products

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3		1	1							
2	3	2	1	1	1	-						
3	2		1	3								

1 **2 Hours**

EXPERIMENT 1

Measurement and estimation of some textual parameters of a solid food and properties of parboiled and raw rice

2 **2 Hours**

EXPERIMENT 2

Estimation of microbial load in food materials

3 **2 Hours**

EXPERIMENT 3

Measurement of fat globule size in milk and determination of homogenization efficiency

4 **2 Hours**

EXPERIMENT 4

Determination of water activity and construction of moisture sorption isotherm of food materials

5 **2 Hours**

EXPERIMENT 5

Determination of the separation efficiency of cream separator

6 **2 Hours**

EXPERIMENT 6

Estimation of thermal processing time and degree of sterilization in canned food using a batch sterilizer

7 **2 Hours**

EXPERIMENT 7

Determination of overall heat transfer coefficient for an evaporator used for concentration of milk.

8 **2 Hours**

EXPERIMENT 8

Determination of drying of fluid entrainment and rate of drying in a drum dryer

9 **2 Hours**

EXPERIMENT 9

Analysis of performance of a spray dryer in terms of outlet temperature and its effect on final quality of the dried product

10 **2 Hours**

EXPERIMENT 10

Experiment on osmotic dehydration of foods

11 **2 Hours**

EXPERIMENT 11

Determination of rehydration ratio of dehydrated foods and Experiment on food extruder and determination of thermal conductivity of food materials

12 **2 Hours**

EXPERIMENT 12

Experiment on microwave oven heating of food

13 **2 Hours**

EXPERIMENT 13

Determination of properties of milk and problems on pasteurization of milk

14 **2 Hours**

EXPERIMENT 14

Experiment on homogenizer and problems on ice-cream mix calculation and freezing of ice-cream

15 **2 Hours**

EXPERIMENT 15

Visit to a dairy industry

Total: 30 Hours

0 0 2 1

15AG708 OPERATION AND MAINTENANCE OF TRACTOR AND FARM IMPLEMENTS LABORATORY

Course Objectives

- To learn about the tools and techniques used for a wide variety of different types of farming operations and landscaping
- To utilize the power tools and mounted implements with the tractor
- To develop skills on safe and efficient use of tractors and power tillers

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Learn about the tools and techniques used for a wide variety of different types of farming operations and landscaping
2. Utilise the power tools and mounted implements with the tractor
3. Possess skills on safe and efficient use of tractors and power tillers
4. Run an Agro Service Centre for Farm Machinery

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3	1	2	-	-	1					
2	1	3	1	2		-	1					
3	1	3	1		2	-	1					
4	1	3	1		2		1					1

1 **2 Hours**

EXPERIMENT 1

Identification of major systems of a tractor and general guidelines and preliminary check measures

2 **2 Hours**

EXPERIMENT 2

Practice of driving the tractor on the road and off the road

3 **2 Hours**

EXPERIMENT 3

Practice in hitching and operating the mould board plough with the tractor - operational adjustments, maintenance and safety aspects

4 **2 Hours**

EXPERIMENT 4

Practice in hitching and operating the disc plough with the tractor - operational adjustments, maintenance and safety aspects

5 **2 Hours**

EXPERIMENT 5

Practice in hitching and operating the rotovator with the tractor - operational adjustments, maintenance and safety aspects

6 **2 Hours**

EXPERIMENT 6

Practice in hitching and operating cultivator with tractor - operational adjustments, maintenance and safety aspects

7 **2 Hours**

EXPERIMENT 7

Study on Periodical maintenance - maintenance and safety aspects for various tillage implements and sowing equipment attached to the tractor and weeding equipment

8 **2 Hours**

EXPERIMENT 8

Practice in operating seed drill with tractor - operational adjustments, maintenance and safety aspects

9 **2 Hours**

EXPERIMENT 9

Practice in operating trailer with tractor - operational adjustments, maintenance and safety aspects

10 **2 Hours**

EXPERIMENT 10

Practice in operating cage wheel with tractor - operational adjustments, maintenance and safety aspects

11 **2 Hours**

EXPERIMENT 11

Study on the trouble shooting and remedies in tractor

12 **2 Hours**

EXPERIMENT 12

Study on periodical maintenance aspects of tractor including tyre and battery

13 **2 Hours**

EXPERIMENT 13

Identification of components of power tiller and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the power tiller

14 **2 Hours**

EXPERIMENT 14

Practice of driving the power tiller on the road and off the road

15 **2 Hours**

EXPERIMENT 15

Practice with post hole digger attached to power tiller- operational adjustments, maintenance and safety aspects

Total: 30 Hours

15AG709 MINI PROJECT V **0 0 2 1**

Course Objectives

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

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

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project

4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		3	2						1		1	
2	-	3	-						2		1	
3				2	3				1		1	
4				3	2				1		1	
5									2	3	1	-

Total: 0 Hours

15GE710 LIFE SKILLS : COMPETITIVE EXAMS 0 0 2 0

Course Objectives

- Understand the concepts of applied mechanics, theory of machines and design.
- Understand the concepts of fluid mechanics and thermal engineering.
- Understand the concepts of materials, manufacturing and industrial engineering.

Programme Outcomes (POs)

Course Outcomes (COs)

1. Solve the problems related to applied mechanics, Theory of Machines and Design concepts
2. Solve the problems related to Fluid Mechanics and Thermal Engineering
3. Explain the concepts of Materials, Manufacturing and Industrial Engineering.

1 **10 Hours**

UNIT 1

Engineering Mechanics-Statics and Dynamics, Mechanics of Materials- deflection of beams, testing of materials, Theory of Machines- Kinematics and Dynamics, Vibrations, Machine Design- design of machine elements, shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

2 **10 Hours**

UNIT 2

Fluid Mechanics, Thermodynamics, Heat-Transfer-conduction, convection and radiation, Power Engineering: Air and gas compressors, I.C. Engines, refrigeration, air-conditioning, Turbomachinery.

3 **10 Hours**

UNIT 3

Engineering Materials, Casting, Forming and Joining Processes, Machining and Machine Tool Operations, Metrology and Inspection, Computer Integrated Manufacturing, Production Planning and Control, Inventory Control, Operations Research.

Total: 30 Hours

Reference(s)

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Learning Pvt. Ltd, New Delhi, 2010
2. Y. Cengel and Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi,2003.
3. R.K. Bansal, A Textbook of Fluid Mechanics and Machinery, Laxmi Publications Ltd., New Delhi, Revised Ninth edition, 2014.

4. V. B. Bhandari, Design of Machine Elements, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2010.
5. Beer, Johnston, Mazurek, Cornwells and Sanghi, Vector Mechanics for Engineers: Statics, Dynamics, 10th Edition, Tata McGraw Hill - Noida, Uttar Pradesh, 2013

15AG804 PROJECT WORK 0 0 0 9

Course Objectives

- To develop knowledge to formulate a real world problem and project goals
- To identify the various tasks of the project to determine standard procedures
- To understand the guideline to prepare report forl oral demonstration

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Identify technical ideas, strategies and methodologies
3. Test and validate through conformance of the developed prototype and analysis the cost effectiveness

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	-	2									
2	2	3	1	-								
3	3	1	2	-								

Total: 0 Hours

LANGUAGE ELECTIVE I

15LE101 BASIC ENGLISH I 3 0 0 3

- To offer students the basics of the English Language in a graded manner.
- To promote efficiency in English Language by offering extensive opportunities for the development of all the four language skills (LSRW) within the classroom.
- To focus on improving and increasing vocabulary.
- To improve spelling and pronunciation by offering students rigorous practice and exercises.
-

Course Outcomes (COs)

1. Converse in English with more confidence.

UNIT I **9 Hours**

BASIC WORDS

Module Vocabulary/ Grammar Skills Sets Skill Sets1 Basic words- 12 most used words in English,

usage and pronunciation Starting a conversation and talking about what one does Sentence construction bolstered by mother tongue Basic words- 20 often used words, usage and pronunciation Analysing an action plan Creating and presenting one's own action plan Basic words with a focus on spelling Discriminative listening Informal conversation Basic words- 10 oft used words, usage and pronunciation Content listening and Intonation Reading comprehension - Unit Test I

UNIT II **9 Hours**

FORMAL CONVERSATION

Module Vocabulary/ Grammar Skills Sets Skill Sets Basic words + greetings to be used at different times of the day Formal conversation Intonation to be used in formal address Last 28 of the 100 most used words Informal conversation between equals Reading practice and peer learning Using the 14 target words to form bigger words Informal dialogues using contracted forms Guided speaking- talking to peers using contracted forms Palindromes, greetings- good luck, festivals Placing a word within its context- culling out meaning Offering congratulations - Unit Test II

UNIT III **9 Hours**

SELF INTRODUCTION

Module Vocabulary/ Grammar Skills Sets Skill Sets Homophones Formal and informal methods of self-introduction Let's Talk is a group activity that gives them some important pointers of speech Homophone partners, matching words with their meanings Contracted forms of the -be verbs, -ve and -s Translating English sentences to Tamil Briefcase words- finding smaller words from a big word Formal and informal ways of introducing others Team work- speaking activity involving group work, soft skills Compound words and pronunciation pointers Giving personal details about oneself Using the lexicon - Unit Test III

UNIT IV **9 Hours**

GRAMMAR

Module Vocabulary/ Grammar Skills Sets Skill Sets Proper and common nouns Asking for personal information and details Pronunciation pointers- an informal introduction to the IPA Pronouns Telephone skills and etiquette Reading aloud and comprehension Abstract and common nouns Dealing with a wrong number Reading practice and comprehension - Group names of animals, adjectives Taking and leaving messages on the telephone Pronunciation pointers - Unit Test IV

UNIT V **9 Hours**

READING COMPREHENSION

Module Vocabulary/ Grammar Skills Sets Skill Sets Determiners Interrupting a conversation politely- formal and informal Pair work reading comprehension Conjugation of the verb to be- positive and negative forms Thanking and responding to thanks Comprehension questions that test scanning, skimming and deep reading Am/is/are questions Giving instructions and seeking clarifications Small group activity that develops dialogue writing Present continuous tense-form and usage Making inquiries on the telephone Finishing sentences with appropriate verbs - Unit Test V

FOR FURTHER READING

Module Vocabulary/ Grammar Skills Sets Skill Sets Words with silent 'b' Present continuous questions Calling for help in an emergency Dialogue writing Words with silent 'c' Simple present tense- form and usage Making requests and responding to them politely Identifying elements of grammar in text extract Simple present tense- rules Describing people Guided writing Words with silent 'g' Questions in the simple present tense Describing places Filling in the blanks with correct markers of tense - Unit Test VI

Total: 45 Hours

Reference(s)

1. Basic English Module, L&L Education Resources, Chennai, 2011.

15LE102 communicative English I 3 0 0 3

Course objective

- To acquire effective listening and reading skills
- To develop speaking and writing skills
- To improve their understanding of grammar, vocabulary and pronunciation

Course Outcomes (COs)

1. Develop their fluency and language competency in English

UNIT I **9 Hours**

GRAMMAR

Content words- Structural words - Subject - Verbs and verb phrase - Subject - Verb agreement - Tenses - Active voice and passive voice - Sentence types (declarative, imperative, exclamatory & interrogative) - Framing questions - Comparative adjective

UNIT II **9 Hours**

LISTENING

Listening for specific information: Short conversations / monologues - Gap filling - Telephone conversations - Note-taking - Listening for gist / interviews - Listening to songs and completing the lyrics - Clear individual sounds - Word stress - Telephone etiquette

UNIT III **9 Hours**

READING

Prediction - Skimming for gist - Scanning for specific information - Understanding text and sentence structure

UNIT IV **9 Hours**

WRITING

Short documents: E-mail - memo - note - message- notice -advertisement -Short reports / proposals - Principles of writing a good paragraph: Unity, cohesion and coherence -Identifying the topic sentence and controlling ideas - Paragraph writing (descriptive, narrative, expository & persuasive)

UNIT V **9 Hours**

SPEAKING

Self-introduction -Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Mini-presentation - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes - Speculation - Tongue twisters

FOR FURTHER READING

Self-Study: Novel Reading -Book Review

Total: 45 Hours

Reference(s)

1. Murphy, Raymond. English Grammar in Use - A Self-Study Reference and Practice Book For Intermediate Learners of English .IVed. United Kingdom: Cambridge University Press. 2012.
2. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.
3. Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press. 2004.

- To give room for a natural acquisition of Basic English Grammar through sample listening, reading and writing inputs
- To specifically focus on speaking and conversation skills with an aim to increase speaking ability
- To improve Spelling and Pronunciation by offering rigorous practice and exercises

Course Outcomes (COs)

1. Communicate better with improved fluency, vocabulary and pronunciation.

UNIT I **9 Hours**

Module Vocabulary / Grammar Skills Sets Skill Sets Difference between Present Continuous and Simple Present tense. Calling for help in an emergency Reporting an event- journalistic styleVerbs 'have' and 'have got' Describing animals Asking for and giving directions Simple Past Tense Inviting people, accepting and declining invitations Self- enquiry and offering one's opinion on a given topic. Spelling rules & table of Irregular Verbs Refusing an invitation Reading and practicing pre-written dialogues

UNIT II **9 Hours**

Questions and the negative form of the simple past tense Apologizing and responding to an apology (Reading) conversation practice. Asking questions in the simple past tense Reading comprehension Seeking, granting and refusing permission. Past continuous tense Paying compliments and responding to them Pair work: writing dialogues and presenting them. Difference between simple past and past continuous- when and where to use each Describing daily routines Reading and comprehension skills

UNIT III **9 Hours**

Simple future tense talking about the weather making plans- applying grammar theory to written work. Simple future tense- more aspects, possessive pronouns Talking about possessions Opening up and expressing one's emotions Future continuous tense Talking about current activities Listening comprehension. Revision of future tense- simple and continuous forms, prepositions used with time and date Asking for the time and date Discussion- analyzing and debating a given topic

UNIT IV **8 Hours**

Articles a/an Writing, speaking and presentation skills Transcribing dictation Singular- Plural (usage of a/an) Reading practice- independent and shared reading Comprehension - logical analysis, process analysis and subjective expression Countable and uncountable nouns- a/an and some Listening comprehension Vocabulary: using context tools to decipher meaning Articles- the Sequencing sentences in a paragraph Listening to a poem being recited, answer questions on it and practice reciting the same

UNIT V **10 Hours**

Articles- the: usage and avoidance Speaking: sharing stories about family, village/town, childhood, etc. students Listening: comprehend and follow multiple step instructions read out by the teacher Articles- the: usage and avoidance with like and hate Speaking: sharing stories about family, village/town, childhood, etc. students Reading: make inferences from the story about the plot, setting and characters Articles- the: usage and avoidance with names of places Speaking: sharing stories about family, village/town, childhood, etc. students Comprehension passage This/ that/ these and those Writing a notice- announcement Speaking: Debate

FOR FURTHER READING

One and ones Collaborative learning- problem solving Writing short answers to questions based on reading. Capitalization and punctuation Controlled writing Listen to a story and respond to its main elements. Syntax and sentence construction- rearrange jumbled sentences Guided writing Listen to a poem and discuss its elements Cloze Free writing Frame simple yet purposeful questions about a given passage.

Total: 45 Hours

Reference(s)

1. Basic English Module, L&L Education Resources, Chennai, 2011.

15LE202 COMMUNICATIVE ENGLISH II 3 0 0 3

Course Objectives

- To acquire skills for using English in workplace effectively
- To communicate for essential business needs
- To prepare students for taking BEC Vantage level examination which is an International Benchmark for English language proficiency of Cambridge English Language Assessment (CELA)
- To enhance the communicative ability from Intermediate to Upper Intermediate level

Course Outcomes (COs)

1. To enable students to get International recognition for work and study.
2. To use English confidently in the International business environments.
3. To be able to take part in business discussion, read company literature, write formal and informal business correspondences and listen and understand business conversations.

UNIT I **9 Hours**

GRAMMAR AND VOCABULARY

Simple, compound and complex sentences - Direct and indirect speech - Conditionals - Business vocabulary - Collocations -Discourse markers

UNIT II **9 Hours**

LISTENING

Listening to identify topic, content, function - Sentence stress - Rhythm - Intonation

UNIT III **9 Hours**

READING

Reading graphs and charts - Skimming and scanning texts - Job advertisements - Read business articles for specific information - Understanding the structure of a text - Error identification

UNIT IV **9 Hours**

WRITING

Formal and Informal English - Longer Documents: writing individual paragraphs to longer text, Business Correspondence, Reports and Proposals - Transcoding

UNIT V **7 Hours**

SPEAKING

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging information - Language Functions: suggesting - comparing and contrasting - expressing - Finding out facts, attitudes and opinions - Commonly mispronounced words

FOR FURTHER READING **2 Hours**

Reading Novels (The Monk Who Sold His Ferrari by Robin Sharma; Three Mistakes of my Life by Chetan Bhagat; The Fountainhead by Ayn Rand)

Total: 45 Hours

Reference(s)

1. Jeremy Comfort, Pamela Rogerson, Trish Stott, and Derek Utley, Speaking Effectively Ã¢?? Developing Speaking Skills for Business English, Cambridge: Cambridge University Press, 2002.
2. Eric H. Glendinning and Beverly Holmstrom, Study Reading: A Course In Reading for Academic Purposes. United Kingdom: Cambridge University Press, 2004.

15LF203 FRENCH 3 0 0 3

Course Objectives

- To help students acquire the basics of French language
- To teach them how to converse in French in various occasions

Course Outcomes (COs)

1. The students will become familiar with the basics of French language and start conversing in French.

UNIT I **6 Hours**

Alphabet Français (alphabets) - Les Accents Français (the accents in French) - aigu - grave - circonflexe - tréma cédille - écrire son nom dans le français (spellingone-sname in French) - Les noms de jours de la semaine (Days of the week)

UNIT II **6 Hours**

Les noms de mois de l'année (Months) - Numéro 1 à 100 (Numbers 1 to 100) GRAMMAIRE :Conjugaison

UNIT III **10 Hours**

Moyens de transport (Transport) - Noms de Professions (Professions) - Noms d'endroits communs (Places) - Nationalités (Nationalities)ECOUTER : (Listening) Écouter l- alphabet associéà des prénoms français - Écouter et répondre PARLER (Speaking)Présntation - même /Présentez- Vous (Introducingoneself)LIRE :Lireles phrases simples

UNIT IV **12 Hours**

Pronoms (Pronouns) - Noms communs masculins et de femme (Common masculine and Femininenouns) - Verbes communs (Common verbs)COUTER :couter et crier les prnoms - Observer les dessins et couter les dialogues LIRE : Lire les profils d'utilisateurs d'interlingua (alter ego)PARLER :Parler de sa ville - Parler de sa profession

UNIT V **11 Hours**

Narration de son nom et l'endroit où on vit - Son âge et date de naissance - Numéro de téléphone et'dresse - Narration du temps - La France en Europe PARLER :Conversation entre deux amis - Jouer la scène ÉCOUTER :Ecouter les conversations (CD alter ego)ÉCRIRE :Écrireune carte postale

Total: 45 Hours

Reference(s)

1. Alter ego+ Niveau a1 ,Catherine Hugot,, HACHETTE LIVRE 2012
2. Cahier alter ego+
3. Grammaire Progressive du Français, CLE international, 2010
4. Collins Easy Learning French Verbs& Practice, Harpercollins, 2012
5. Barron's Learn French, 3rd edition
6. Français Linguaphone, Linguaphone Institute Ltd., London, 2000. FrançaisI. Harrisonburg: The Rosetta Stone: Fairfield Language Technologies, 2001.

Course Objectives

15LG203
GERMAN **3 0 0 3**

- To help students acquire the basics of German language
- To teach them how to converse in German in various occasions

Course Outcomes (COs)

1. An ability to communicate effectively with: (a) Clarity on the basic sounds of the German language (b) Improved fluency in German (c) Proper vocabulary

UNIT I **9 Hours**

GRAMMAR

Introduction to German language: Alphabets, Numbers - Nouns - Pronouns Verbs and Conjugations - definite and indefinite article - Negation - Working with Dictionary - Nominative - Accusative and dative case - propositions - adjectives - modal auxiliaries - Imperative case - Possessive articles.

UNIT II **9 Hours**

LISTENING

Listening to CD supplied with the books, paying special attention to pronunciation: Includes all lessons in the book - Greetings - talking about name - country - studies - nationalities - ordering in restaurants - travel office - Interaction with correction of pronunciation.

UNIT III **9 Hours**

SPEAKING

Speaking about oneself - about family - studies - questions and answers - dialogue and group conversation on topics in textbooks - talks on chosen topics.

UNIT IV **9 Hours**

READING

Reading lessons and exercises in the class - pronunciation exercises: Alphabet: name, country, people, profession, family, shopping, travel, numbers, friends, restaurant, studies – festivals

UNIT V **9 Hours**

WRITING

Alphabets, numbers - words and sentences - Exercises in the books - control exercises - writing on chosen topics such as one self, family, studies - country.

Total: 45 Hours

Reference(s)

1. Grundkurs DEUTSCH A Short Modern German Grammar Workbook and Glossary, VERLAG FUR DEUTSCH, Munichen, 2007.
2. Grundkurs, DEUTSCH Lehrbuch Hueber Munichen, 2007.
3. Cassel Language Guides - German: Christine Eckhard, Black & Ruth Whittle, Continuum, London / New York, 1992.

15LH203 HINDI **3 0 0 3**

Course Objectives

- To help students to acquire the basics of Hindi
- To teach them how to converse in Hindi on various occasions
- To help learners acquire the ability to understand a simple technical text in Hindi

Course Outcomes (COs)

1. An ability to communicate effectively with: (a) Improved fluency in Hindi (b) Clarity on the basic sounds of the Hindi language (c) Proper vocabulary

UNIT I **9 Hours**

HINDI ALPHABET

Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu &Visarg -Table of Alphabet -Vocabulary.

UNIT II **9 Hours**

NOUNS IN HINDI

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises.

UNIT III **9 Hours**

PRONOUNS AND TENSES

Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

UNIT IV **9 Hours**

CLASSIFIED VOCABULARY

Parts of body - Relatives - Spices- Eatables- Fruit & Vegetables - Clothes - Directions-Seasons - Professions.

UNIT V **9 Hours**

SPEAKING

Model Sentences - Speaking practice for various occasions.

Total: 45 Hours

Reference(s)

1. B. R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications (P) Ltd., New Delhi, 2009.
2. Syed, PrayojanMulak Hindi, RahamathullahVaniPrakasan, New Delhi, 2002.
3. Ramdev, VyakaranPradeep, SaraswathiPrakasan, Varanasi, 2004.

15LJ203 JAPANESE **3 0 0 3**

Course Objectives

- To help students acquire the basics of Japanese language
- To teach them how to converse in Japanese in various occasions
- To teach the students the Japanese cultural facets and social etiquettes
-

Course Outcomes (COs)

1. An ability to communicate effectively with: (a) Improved fluency in Japanese (b) Clarity on the basic sounds of the Japanese language (c) Proper vocabulary

UNIT I **9 Hours**

Introduction to Japanese - Japanese script - Pronunciation of Japanese (Hiragana) - Long vowels - Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions - Numerals. N1 wa N2 des - N1 wa N2 ja arimasen - S ka - N1mo - N1 no N2 - .san - Kanji - Technical Japanese Vocabulary (25 Numbers) - Phonetic and semantic resemblances between Tamil and Japanese

UNIT II **9 Hours**

Introduction - Kore - Sore - are - Kono N1 - Sono N1 - ano N1 - so des - so ja arimasen - S1 ka - S2 ka - N1 no N1 - so des ka ' koko - soko - asoko - kochira - sochira - achira - N1 wa N2 (Place) des - dhoko-N1 no N2 - Kanji-10 - ima-.ji-fun des - Introduction of verb - V mas - V masen - V mashitha - V masen deshitha - N1(Time) ne V - N1 kara N2 des - N1 tho N2 / S ne Kanji-10 - Technical Japanese Vocabulary (25 Numbers) - Dictionary Usage.

UNIT III **9 Hours**

N1(Place) ye ikimas - ki mas - kayerimasu - Dhoko ye mo ikimasen - ikimasendheshitha - N1(vehicle) de ikimasu - kimasu - kayerimasu - N1(Personal or Animal) tho V ithsu - S yo. - N1 wo V (Transitive) - N1 wo shimus - Nani wo shimasu ka - Nan & Nani - N1 (Place) de V - V masen ka - V masho - Oo. Kanji-10 , N1(tool - means) de V - Word / Sentence wa go nan des ka - N1(Person) ne agemus - N1(Person) ne moraimus - mo V shimashitha - , Kanji-10 - Japanese Typewriting using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

UNIT IV **9 Hours**

Introduction to Adjectives - N1wanaadj des. N1 wa ii adj des - naadjna N1 - ii adj ii N1 - Thothemo - amari - N1 wadho des ka - N1 wadhonna N2 des ka - S1 ka S2 - dhore - N1 gaarimasu - wakarimasu - N1 ga suki masu - N1 gakiraimasu - jozu des - hetha des - dhonna N1 - Usages of yoku - dhaithai - thakusan - sukoshi - amari - zenzen - S1 kara S2 - dhoshithe, N1 gaarimasu - imasu - N1(Place) ne N2 gaarimasu - iimasu - N1 wa N2(Place) ne arimasu - iimasu - N1(Person,Place,or Thing) no N2 (Position) - N1 ya N2, Kanji-10 - Japanese Dictionary usage using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

UNIT V **9 Hours**

Saying Numbers , Counter Suffixes , Usages of Quantifiers -Interrogatives - Dhonokurai - gurai - Quantifier-(Period) ne -.kai V - Quantifier dhake / N1 dhake Kanji - Past tense of Noun sentences and na Adjective sentences - Past tense of ii-adj sentences - N1 wa N2 yoriadj des - N1 tho N2 tho Dhochiragaadj des ka and its answering method - N1 [no naka] de {nani/dhoko/dhare/ithsu} ga ichiban adj des ka - answering -N1 gahoshi des - V1 mas form dhake mas - N1 (Place) ye V masu form ne ikimasu/kimasu/kayerimasu - N1 ne V/N1 wo V - Dhokoka - Nanika - gojumo - Technical Japanese Vocabulary (25 Numbers)

Total: 45 Hours

Reference(s)

1. Japanese for Everyone: Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
2. Japanese for Everyone: Elementary Main Textbook 1-2, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
3. Software 1. Nihongo Shogo-1 2. Nihongo Shogo-2 3. JWPCE Software
4. www.japaneselifestyle.com
5. www.learn-japanese.info/
6. www.kanjisite.com/
7. www.learn-hiragana-katakana.com/typing-hiragana-characters/

PHYSICS ELECTIVE

15PH201 PHYSICS OF MATERIALS **3 0 2 4**

Course Objectives

- To understand the physical properties of conductors, semiconductors and superconductors
- To recognize the basic principles of interaction of light with matter and working of optical devices
- To classify the types of dielectric, magnetic materials and polarization mechanisms with their properties

Course Outcomes (COs)

1. Exemplify the physical properties of conductors, superconductors and semiconductors with applications
2. Identify the suitable semiconducting material for solar cell applications
3. Select the suitable materials for insulating and dielectric applications
4. Compare the optical properties of display devices
5. Analyze the properties of magnetic materials for practical applications

UNIT I **9 Hours**

CONDUCTING AND SUPERCONDUCTING MATERIALS

Electrical and thermal conductivity of metals - Wiedemann Franz law - band theory of metals - density of states. Superconductors: properties - types - High Tc superconductors- applications.

UNIT II **10 Hours**

SEMICONDUCTORS

Elemental and compound semiconductors - intrinsic semiconductors: carrier concentration - electrical conductivity- band gap. Extrinsic semiconductors: carrier concentration - variation of Fermi level. Hall effect: theory and experimental determination -applications: Solar cells

UNIT III **9 Hours**

DIELECTRIC MATERIALS

Types of polarization: electronic, ionic, orientation and space charge polarization mechanisms - Langevin-Debye equation - frequency and temperature effects on polarization - dielectric strength and loss -dielectric breakdown mechanisms - active dielectric materials: pizo, pyro and Ferro electricity - applications.

UNIT IV **9 Hours**

OPTICAL MATERIALS

Interaction of light with materials - optical absorption - transmission - Luminescence in solids - Fluorescence and Phosphorescence - Optical band gap - LED ,LCD.

UNIT V **8 Hours**

MAGNETIC MATERIALS

Classification and properties - domain theory - hard and soft magnetic materials - anti-ferro and ferri magnetic materials - applications: magnetic recording and memories.

FOR FURTHER READING

Photonic crystals - LIFI

PRACTICAL EXPERIMENTS

EXPERIMENT 1 **2 Hours**

Exposure to Engineering Physics Laboratory and precautionary measures

EXPERIMENT 2 **4 Hours**

Using Lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.

EXPERIMENT 3 **4 Hours**

Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the given semiconductor.

EXPERIMENT 4 **4 Hours**

With the aid of travelling microscope, find the refractive index of a transparent solid and liquid material.

EXPERIMENT 5 **4 Hours**

Determine the wavelength of polychromatic source in the visible region using spectrometer.

EXPERIMENT 6 **4 Hours**

Based on Hall effect, calculate the charge carrier density of a given semiconductor and identify the nature of the semiconductor.

EXPERIMENT 7 **4 Hours**

Draw the B-H curve of a ferromagnetic material subjected to external magnetic field and hence identify the nature of the material.

EXPERIMENT 8 **4 Hours**

Determine the V-I characteristics of a solar cell.

Total: 45 + 30 = 75 Hours

References

1. Saxena, Gupta, Saxena, Mandal, Solid State Physics, Pragati Prakashan Educational Publishers, 13th revised edition, Meerut, India, 2013.
2. M.N. Avadhanulu and P.G. Kshirsagar, A Text Book of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2011.
3. S. O. Pillai, Solid State Physics, New Age International Publications, New Delhi, 2010.
4. M.A. Wahab, N.K. Mehta, Solid state physics-structure and properties of materials, Narosa publishing house Pvt. Ltd, 6th edition, 2010.
5. Semiconductor Physics and Devices, Donald A. Neamen , Mc Graw-Hill, 2011.
6. P.K. Palanisamy, Materials Science, Scitech Publications India Pvt. Ltd, 2014.

15PH202 APPLIED PHYSICS 3 0 2 4

Course Objectives

- To understand conducting, semiconducting, dielectric and magnetic properties of materials and exemplify their applications
- To analyze the basic concepts of thermodynamics and heat transfer with illustrations
- To gain knowledge about acoustical standards of buildings

Course Outcomes (COs)

1. Differentiate the materials based on their properties and suit them for appropriate applications
2. Select the suitable materials for insulating and dielectric applications
3. Investigate the working mechanisms and efficiency of heat engines by applying the laws of thermodynamics
4. Compare the different heat transfer mechanisms and its applications
5. Choose the proper acoustic materials for the construction of buildings

UNIT I **11 Hours**

CONDUCTORS AND SEMICONDUCTORS

Conductors: Classical free electron theory - electrical and thermal conductivity- Wiedemann -Franz law - merits and demerits of classical free electron theory - band theory - density of states. Semiconductors: Elemental and compound semiconductors - intrinsic semiconductors -Fermi level and electrical conductivity - band gap energy - extrinsic semiconductors - n-type and p-type semiconductors: variation of Fermi level with temperature (qualitative) - Hall effect - applications.

UNIT II **9 Hours**

DIELECTRIC AND MAGNETIC MATERIALS

Dielectrics: Fundamental terminologies - electronic and ionic polarizations - orientation polarization mechanism (qualitative) - space charge polarization - Langevin -Debye equation - dielectric loss - applications of dielectric and insulating materials. Magnetic Materials: Properties of dia, para and ferromagnetic materials - domain theory of ferromagnetism - hysteresis curve - hard and soft magnetic materials – applications

UNIT III **9 Hours**

THERMODYNAMICS

Zeroth law of thermodynamics - Heat - equilibrium and quasistatic process - path functions - comparison between heat and work - internal energy - first law of thermodynamics - isothermal and adiabatic process - work done - reversible and irreversible process - second law of thermodynamics - entropy - enthalpy - Carnot ideal engine and its efficiency - Carnot's theorem-actual heat engine: Diesel engine and its efficiency

UNIT IV **9 Hours**

HEAT TRANSFER

Modes of heat transfer - thermal conductivity - heat capacity and diffusivity - rectilinear flow of heat - conduction through bodies in series and parallel - determination of thermal conductivity: good conductor: Searle's method - bad conductor: Lee's disc method - applications of heat transfer: formation of ice in ponds - conductivity of earth's crust and age of earth - practical applications

UNIT V **7 Hours**

ACOUSTICS

Classification of sound based on frequency - characteristics of audible sound - reverberation time: Sabine's formula - determination of absorption coefficient - Erying's formula (qualitative). Sound insulation - sound absorbing materials - factors affecting the acoustics of building – remedies

FOR FURTHER READING

Nanomaterials and its applications

PRACTICAL EXPERIMENTS **2 Hours**

EXPERIMENT 1

Exposure to Engineering Physics Laboratory and precautionary measures

EXPERIMENT 2 **4 Hours**

Using Lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.

EXPERIMENT 3 **4 Hours**

Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the given semiconductor.

EXPERIMENT 4 **4 Hours**

With the aid of traveling microscope, find the refractive index of a transparent solid and liquid material

EXPERIMENT 5 **4 Hours**

Determine the wavelength of polychromatic source in the visible region using spectrometer

EXPERIMENT 6 **4 Hours**

Based on Hall Effect, calculate the charge carrier density of a given semiconductor and identify the nature of the semiconductor.

EXPERIMENT 7 **4 Hours**

Draw the B-H curve of a ferromagnetic material subjected to external magnetic field and hence identify the nature of the material.

EXPERIMENT 8 **4 Hours**

Determine the V-I characteristics of a solar cell.

Total: 45+30 = 75 Hours

Reference(s)

1. William D. Callister, Materials Science and Engineering an Introduction, John Wiley and Sons,Inc, 2010
2. BrijLal, N. Subrahmanyam and P. S. Hemne, Heat, Thermodynamics & Statistical Physics, S. Chand & Company Ltd., New Delhi, 2012
3. Saxena, Gupta, Saxena, Mandal, Solid State Physics, Pragati Prakashan Educational Publishers, 13threvised edition, Meerut, India, 2013
4. P.K. Mittal, Applied Physics, I.K. International Publishing House Pvt. Ltd, 2008
5. Donald A. Neamen, Semiconductor Physics and Devices,McGraw-Hill, 2011

CHEMISTRY ELECTIVE

15CH202 APPLIED CHEMISTRY **3 0 2 4**

Course Objectives

- Understand the necessity of water softening processes.
- Recognize the fundamentals of corrosion, alloys, phase rule and fuels with its applications.
- Characterize the chemical compounds using analytical techniques.

Course Outcomes (COs)

1. Attribute the internal and external treatment methods for the removal of hardness in water for domestic and industrial applications.
2. Exemplify the type of corrosion and its mechanism which will help to develop the corrosion control methods.
3. Apply the applications of alloying and phase rule in the field of metallurgy.
4. Analyse the three types of fuels based on calorific value for selected applications.
5. Recognize the applications of analytical methods in characterizing the chemical compounds.

UNIT I **10 Hours**

WATER PURIFICATION

Hardness of water - classification of hardness (temporary and permanent) - units of hardness (ppm, mg/l, degree Clark, degree French) - expression of hardness in terms of calcium carbonate equivalence - estimation of hardness by EDTA Method - Uses of water for industrial purpose - requirements of boiler feed water - disadvantages of using hard water in industrial boilers: scale, sludge, priming, foaming and caustic embrittlement. Removal of dissolved salts from hard water: internal conditioning (phosphate, carbonate, calgon and colloidal methods), external conditioning (ion exchange process, reverse osmosis, electrodialysis). Uses of water for domestic purpose - municipal water treatment (screening, aeration, coagulation, sedimentation, filtration and disinfection of water - break point chlorination).

UNIT II **8 Hours**

CORROSION SCIENCE

Corrosion - chemical and electrochemical corrosion - Pilling-Bedworth rule - mechanism (types of oxide layer, oxygen absorption - hydrogen evolution) - Galvanic series -types of electrochemical corrosion: Galvanic corrosion - differential aeration corrosion (pitting, pipeline and waterline)- Factors influencing corrosion (nature of metal and environment). Corrosion control: sacrificial anode - impressed current method.Protective coatings - paint -constituents and functions.

UNIT III **9 Hours**

ALLOYS AND PHASE RULE

Alloys: purpose of alloying - function and effects of alloying elements - properties of alloys - classification of alloys. Ferrous alloys: nichrome and stainless steel. Non-ferrous alloys: brass and bronze. Heat treatment of alloys (annealing, hardening, tempering, normalising, carburizing and nitriding). Phase rule: phase - component - degree of freedom - phase rule - phase diagram - applications- one component system (water system). Reduced phase rule - two component system (lead and silver system).

UNIT IV **10 Hours**

FUELS

Classification - characteristics - calorific value - solid fuel - coal - types - analysis of coal (proximate and ultimate analysis) - processing of coal to coke - carbonization - types (low temperature and high temperature carbonization) - manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels - petroleum - refining of crude oil - knocking - octane number - cetane number. Liquid fuel from coal (Bergius process). Gaseous fuels - natural gas (CNG) - coal gas - producer gas - syn gas - shale gas.

UNIT V **8 Hours**

INSTRUMENTAL METHODS

Beer - Lamberts law. Principle, instrumentation (block diagram only) and applications: Ultra violet spectroscopy - Infrared spectroscopy - Atomic absorption spectroscopy - Colorimetry (estimation of transition metal) - Flame photometry (estimation of alkali metal).

FOR FURTHER READING

Synthesis and applications of bio-fuels.

PRACTICAL EXPERIMENTS

EXPERIMENT 1 **2 Hours**

Preparation of N/10 oxalic acid and N/10 sodium carbonate solution.

EXPERIMENT 2 **4 Hours**

Water quality of BIT campus - River - Bore well water with respect to hardness, TDS and pH.

EXPERIMENT 3 **4 Hours**

Conduct metric titration of mixture of acids (HCl CH3COOH).

EXPERIMENT 4 **4 Hours**

Determination of strength of hydrochloric acid in a given solution using pH meter.

EXPERIMENT 5 **4 Hours**

Determination of the strength of Fe(II) in the given sample by potentiometric method.

EXPERIMENT 6 **4 Hours**

Measurement of rate of corrosion on mild steel in aerated / neutral / acidic / alkaline medium by weight loss method.

EXPERIMENT 7 **4 Hours**

Estimation of copper content in brass by EDTA method.

EXPERIMENT 8 **4 Hours**

Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method.

Total: 45+30 = 75 Hours

Reference(s)

1. A. Pahari and B.Chauhan, Engineering Chemistry, Infinity Science press LLC, New Delhi, 2010.
2. M. Munjal and S.M. Gupta, Wiley Engineering Chemistry, Second edition, Wiley India Pvt. Ltd, New Delhi, 2013.
3. Willard Merritt and Dean Settle, Instrumental methods of analysis, CBS publishers, Seventh edition, 2012.
4. Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishers New Delhi, 16th Edition, 2013.
5. R. Mukhopadhy and S. Datta, Engineering Chemistry, New age international Pvt. Ltd, New Delhi, 2010.
6. Shashi Chawla, Engineering Chemistry, Dhanpat Rai Publishers New Delhi, 2nd Edition, 2003.

DISCIPLINE ELECTIVES

15AG001 BUILDING MATERIALS, ESTIMATION AND COSTING

3 0 0 3

Course Objectives

- To understand the fundamental knowledge on different building materials
- To impart knowledge on design of different aspects of building construction
- To learn to prepare detailed estimate and cost estimate of buildings

Course Outcomes (COs)

1. Possess the knowledge on the different types and components of buildings.
2. Prepare detailed estimate of buildings/farm structures
3. Prepare cost estimate of buildings/farm structures

UNIT I **9 Hours**

STONES AND BRICKS

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 **9 Hours**

LIME AND CEMENT

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.

UNIT III **9 Hours**

BRICK, STONE MASONRY AND FOUNDATION

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 - General principles - classification of brick masonry-precautions in brick masonry -Stone Masonry -Comparison between Brick and Stone Masonry -Classification -General Principles and precautions in stone masonry

UNIT IV **9 Hours**

BUILDING CONSTRUCTION

Walls -Classification of walls - Dampness -Causes of Dampness -Methods of Preventing Dampness -Damp Proofing materials - Methods of providing Damp Proofing Materials-Mortars -Functions and Types of mortars -Concrete -Characteristics -Types and uses - Cube Strength of Concrete-Roofs - Classification - Floors -Types of Floor-Types of Plastering and Pointing -Painting and Distempering

UNIT V **9 Hours**

ESTIMATING AND COSTING

PWD schedule of rates - data sheet - detailed estimate - abstract estimate - preparation of estimate.

FOR FURTHER READING

Estimating and costing of farm structures- irrigation systems- farm ponds- poultry shed- dairy barn

Total: 45 Hours

References

1. S.V Deodhar and Singhal, Civil engineering materials. Khanna publishers, 2B, Nath market, Naisark, Delhi - 2001.
2. S.C. Rangwala, Building construction, Charotar publishing house, Anand, 2000.
3. B.L. Handoo and V.M. Mahajan, Civil engineering materials. Sathyaprakasam, 16/7698, New market, New Rohtak road, New Delhi-5, 1995
4. N.L. Arora and B.R. Gupta, Building construction. Sathyaprakasham, 16/7698, New market, New Rohtak road, New Delhi -5, 1995
5. S.C Rangwala, Estimating and costing, Charotar book stall, Station road, Anand, 1991.
6. B.N. Datta, Estimation and costing. Published by the Author, Tagore Palli, Motilal Bose road, Lucknow, 2002

15AG002 REFRIGERATION AND AIR CONDITIONING

3 0 0 3

Course Objectives

- To interpret principles of operation of different Refrigeration & Air conditioning systems
- To understand the types of compressors and expansion devices and their applications
- To combine the parameters involved in design of the various air conditioning systems

Course Outcomes (COs)

1. Elucidate the principles and practice of thermal comfort
2. Analyse the vapor compression and heat-driven refrigeration systems
3. Apply the knowledge on psychometric chart for designing heating and refrigeration units
4. Identify various types of air conditioning systems and their application in food industry
5. Evaluate applications and make design calculations of Heating, Ventilation and Air conditioning systems

UNIT I **10 Hours**

REFRIGERATION PRINCIPLES AND COMPONENTS

Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - Refrigeration components –compressor – classification-principle and working- condensers-types-construction, principle and working. Evaporators – types-principle and working. Expansion device – types construction, principle and working. Refrigerants – properties – classification – comparison and advantages – chloroflouro carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants

UNIT II **9 Hours**

VAPOUR COMPRESSION AND VAPOUR ABSORPTION CYCLE

Simple vapour compression cycle – T-S diagram – p-h chart- vapour compression system-different types-vapour absorption cycle – simple and practical vapour absorption system- advantages- ideal vapour absorption system- Electrolux refrigerator – Lithium bromide refrigeration-construction and principles.

UNIT III **9 Hours**

APPLIED PSYCHROMETRY

Principle and properties of psychrometry, Representation of various psychometric processes on psychometric chart and their analysis, by-pass factor, sensible heat factor, room sensible heat factor, equipment sensible heat factor, grand sensible heat factor, apparatus dew point, ventilation and infiltration, energy efficiency ratio. Use of psychometric charts. Cooling and heating load calculations

UNIT IV **9 Hours**

AIR CONDITIONING SYSTEM

Air conditioning systems-equipment used-classification-comfort and Industrial air conditioning system- winter, summer and year- round air conditioning system- unitary and central air conditioning system- application of refrigeration and air conditioning-domestic refrigerator and freezer-refrigerated trucks- ice manufacture- cold storage-freeze drying.

UNIT V **8 Hours**

APPLICATIONS OF REFRIGERATION IN FOOD PROCESSING AND PRESERVATION

Cooling and heating load estimation, cold storage – design, types of cooling plants for cold storage. Insulation – properties and types of insulation material. Cold storage for milk, meat, fruits, vegetables, poultry and marine products. Refrigerated Transport, Handling and Distribution, Cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display.

FOR FURTHER READING

Design of cold storage

Total: 45 Hours

References

1. C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2008
2. Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice Hall of India, New Delhi, 2009
3. Roy J. Dossat, Principles of Refrigeration, Pearson Education, New Delhi, 2007
4. N. F Stoecker and Jones, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi, 2008
5. Manohar Prasad, Refrigeration and Air Conditioning, Wiley Eastern Ltd., 2007
6. J. B Hains, Automatic Control of Heating & Air conditioning, Tata McGraw Hill Publishing Company Private Limited, 2005

15AG003 STORAGE AND PACKAGING TECHNOLOGY 3 0 0 3

Course Objectives

- To study about the different storage structures
- To learn about the different packaging materials and various methods of packaging to improve the shelf life of the products
- To understand the concepts of Controlled Atmosphere Storage and Modified Atmosphere Packaging
- To learn about the equipment used for packaging

Course Outcomes (COs)

1. Possess the knowledge on Storage environment and storage structures
2. Recognize the importance of packaging and Acquaint with the equipment used for packaging apply
3. Determine the principles of Controlled Atmosphere Storage and Modified Atmosphere Packaging
4. Differentiate various canning systems and their application in food industry
5. Apply the knowledge to choose suitable flexible packaging film and the sealing technique for processed foods

UNIT I **11 Hours**

STORAGE ENVIRONMENT AND STORAGE STRUCTURES

Storage losses in agricultural commodities. Physical properties of grain affecting storability- Factors of spoilage- fungi and mycotoxins- Treatments for enhancing shelf life- Fumigation Processes for bag storage piles. Rural storage structures- Bag Storage and its Design. Parameters and types of

storage structure. Bulk Storage in silos and large Bins – Construction of Silos, Problems of Silo storage, relative Costs of Silo and Bag Storage. Quality Changes and remedial measures of Grains during storages. Design considerations and heat load calculation of cold storage.

UNIT II **8 Hours**

INTRODUCTION TO PACKAGING

Introduction – Protection of Food products – major role and functions of food packaging – Effect of environmental factors, mechanical forces and biological factors on food quality and shelf life. Estimating the shelf life requirement – accelerated storage studies. Tests on packaging materials – Mechanical strength (Tension, notch and tearing strengths), Gas and water vapour transmission rates

UNIT III **10 Hours**

CONTROLLED ATMOSPHERE STORAGE AND MODIFIED ATMOSPHERE PACKAGING

Introduction and concept of CA Storage – Equipment for creating, maintaining and measuring controlled atmosphere - Biochemical aspects of CA storage - Static & Dynamic CA, Fruit Ripening, Hypobaric and Hyperbaric Storage. Effects of concentrations of compositional gases on Fruits and vegetables. MAP-Film & Coating types, Permeability, Gas Flushing, Perforation, Absorbents, Humidity, Temperature, Chilling Injury, Shrink wrapping, Vacuum Packing, Modified Interactive Packaging, Minimal Processing, Equilibrium Modified Atmosphere Packaging, Effect of scavengers.

UNIT IV **10 Hours**

CANNING

Metal Cans and Glass Bottles as Packaging. Types of Metallic cans. Basics of Canning operations, Can closures. Glass jars and Bottles in food packaging, Design features and applications, Sterilization of bottles, advantages and problems, Bottle and jar closures, different types of caps and liners used. Can double seam – can seam formation and defects, Metal caps for bottles and jars – applications. Plastics used and their Specific applications - Polyethylene (LDPE and HDPE), Cellulose, Polypropylene (PP), Polyesters, Polyvinylidene Chloride (PVDC – Diofan, Ixan and Saran), Polyvinyl chloride, Copolymers their applications. Closing and sealing of Rigid plastic containers – Seal types.

UNIT V **6 Hours**

FLEXIBLE FILMS PACKAGING

Formation of Films and pouches, Co-extruded films and Laminates – applications. Filling and Sealing of pouches and flexible plastic containers, Pouch form fill seal machines: Rigid and Semi rigid plastic packaging. Fabrication methods – Thermo forming, Blow moulding, Injection moulding, Extrusion Blow moulding – applications. Laminated Paper board Cartons, Fibre Board and Corrugated Card Board packaging - applications. Printing on packages, Bar codes, Nutrition labeling and legislative requirements.

FOR FURTHER READING

Active packaging and Oxygen scavenging- applications of Modified atmosphere packaging- Vacuum and Inert Gas Packaging. Transport systems or technology for CAS and MAP.

Total: 45 Hours

References

1. Samuel Matz, The Chemistry and Technology of Cereals as Food and Feed, Chapman & Hall, 1992
2. N.L.Kent and A.D.Evans, Technology of Cereals (4th Edition) Elsevier Science (Pergaman), Oxford, UK,1994.
3. Ruth H. Matthews: Pulses – Chemistry, Technology and Nutrition Mercel Dekker Inc., USA,1989

4. Gordon L. Robertson, Food Packaging- Principles and Practice Marcel Dekker Inc, USA, 1993
5. Donald Downing, Complete Course in Canning (3 Volumes) CTI Publications Inc, USA, 1996

15AG004 TECHNOLOGY OF SEED PROCESSING 3 0 0 3

Course Objectives

- To acquire the knowledge on the various seed production and processing technologies
- To impart knowledge on seed testing and the methods
- To impart knowledge about seed certification, legislation and industries in India

Course Outcomes (COs)

1. Classify various technologies available in seed production
2. Identify the seed processing techniques and identify various seed processing equipment
3. Learn the different methods and procedure to test the seeds
4. Gain the knowledge on certification and legislation in seed industries
5. Recognize the growth of seed industry and their role in India

UNIT I **9 Hours**

SEED PRODUCTION TECHNOLOGY

General Principles: Genetic principles, Agronomic principles, seed morphology, shape, size, seed hardness, colour; Harvesting of seed crops. Nucleus and Breeder's seed, method of maintenance of nucleus and Breeder's seed in self, fertilized and cross, fertilized crops, Foundation and certified seed production; Seed production of cereals, pulse, oil seeds, fibre crops, forage crops, sugar crops and their hybrid verities; physiological and harvestable maturity of different kinds of seeds.

UNIT II **10 Hours**

SEED PROCESSING TECHNOLOGY

Preparing seed for processing, Seed moisture and drying, Air screen cleaner, shape and size separators, gravity separators, surface texture separators, affinity for liquid separators, colour separators, electrical conductivity separators; seed treatment; seed elevators, conveyors, safe seed storage, seed packaging and handling, seed bins, dust removal, seed blending, seed marketing and distribution; methods for assessment of seed quality.

UNIT III **9 Hours**

SEED TESTING

Sampling methods, Determination of seed density, Tolerances, hetrogenity, Purity, genuineness of variety. Moisture estimation, Germination, equipment, seed scarification, pre sowing treatment, seed priming, pelleting; Viability: Vigour and health.

UNIT IV **9 Hours**

SEED CERTIFICATION AND LEGISLATION

Objectives and concepts of seed certification, seed certification agencies, minimum seed certification standards for breeder's seed, certified seed. Field and seed inspection, methods of inspection, post harvest inspection. Seed legislation loss.

UNIT V **8 Hours**

SEED INDUSTRY IN INDIA AND THEIR ROLE IN AGRICULTURAL DEVELOPMENT

Development of Seed industries in India: overview, National seeds corporation, State seeds Development Corporation. Five year plans. Private seed industries.

FOR FURTHER READING
Ozone treatment of seeds

Total: 45 Hours

References

1. J.F Harrington and J.E Douglas, "Seed storage and packaging application", NSC, New Delhi, 1963.
2. J.E Douglas, "Seed Production Mannual", National Seeds Corporation and Rockfeller Foundation, New Delhi, 1969.
3. J.E Douglas, "Seed Certification Mannual", National seeds corporation, New Delhi, 1970.
4. B.R Gregg, A.G. Law, S.S Virdi and J.S Balis "Seed Processing", National seed corporation, New Delhi, 1990.
5. R.L Agrawal, A text book on "Seed Technology", Oxford & IBH Publication, Co Pvt Ltd, New Delhi-1992.
6. L.O Copeland and M.B Mc Donald, "Principles of Seed Science and Technology", Chapman and Hall, New York, 1995.

15AG005 FAT AND OIL PROCESSING 3 0 0 3

Course Objectives

- To understand about the physical and chemical properties of fats and oils
- To learn the extraction and refining processes of oils
- To learn about packaging, quality standards of fats and oils

Course Outcomes (COs)

1. Explain various physical and chemical properties of fats and oils
2. Possess the knowledge on different oil extraction processes
3. Recognize the objectives of refining and various methods used for refining oils
4. Apply the knowledge on packaging materials to select better packaging material for oils
5. Determine the industrial applications of oils and different quality standards for oils

UNIT I **10 Hours**

PHYSICAL AND CHEMICAL PROPERTIES

Fats and oils – Physical and chemical properties –formation – functions of oil in human body – fatty acids – double bonds and their position in oil – Geneva type – classification – sources of vegetable oils – production status-oil content – coconut , palm, peanut , rice bran, sesame, mustard and sunflower seeds oil – physical and chemical properties of fats and oils – chemical reactions of oil – hydrolysis – hydrogenation, oxidation and polymerization.

UNIT II **10 Hours**

EXTRACTION METHODS

Oil extraction methods –mechanical expression – ghani , power ghani, rotary, hydraulic press, screw press, expellers, filter press – principle of operation and maintenance-solvent extraction process – steps involved, batch and continuous-continuous solvent extraction process for rice bran, soy bean and sunflower-oil extraction process for groundnut and cotton seed-production of special oils – palm oil, coconut oil – extraction process.

UNIT III **10 Hours**

REFINING OF OILS

Refining of oils – objectives – characterization – degumming – Zeneath process – deacidification process – continuous acid refining-bleaching of oil – continuous bleaching process – decolourising agents-deodorization process –winterization processes-hydrogenation of oil – selectivity – catalyst – batch type hydrogenation –regeneration of catalyst-vanaspathi, ghee and margarine – production

process-partial sterilization, emulsification, chilling, kneading and rolling, incorporation of salt, colouring substances-production of special fats- butter – types – production and storage.

UNIT IV **9 Hours**

PACKAGING OF EDIBLE OILS

Packaging of edible oils – requirements –types –tin plate, semi rigid, glass, Polyethylene Terephthalate, Poly Vinyl Chloride, flexible pouches – packaging for vanaspati and ghee changes during storage of oil –rancidity – causes – atmospheric oxidation and enzyme action –free fatty acid – colour-non edible oils –castor oil, linseed oil, vegetable waxes – production and processing.

UNIT V **6 Hours**

INDUSTRIAL APPLICATIONS AND QUALITY STANDARDS

Industrial applications of fats and oils – quality regulations – manufacture of soap, candle, paints and varnishes – ISI and Agmark standards – site selection for oil extraction plant- safety aspects HACCP standards in oil industries.

FOR FURTHER READING

Study of quality parameters of cooked oil.

Total: 45 Hours

References

1. Harry Lawson, Food oils and Fats, Technology, Utilization and Nutrition, CBS Publishers and Distributors, New Delhi, 1997.
2. T.J. Weiss, Food Oils and their uses, The AVI Publishing Company, Inc. Westport, Connecticut, 1970.
3. K.T. Acharia, Oil seeds and oil milling in India. Oxford and IBH publication, New Delhi, 1990.
4. H. Panda, Essential oils – Hand book, National Institute of Industrial Research, ISBN, New Delhi, 2000.
5. Anonymous, Handbook of oils, fats and derivatives with refining and packaging technology, Engineers India Research Institute, New Delhi, 2004.
6. T.P. Hilditch, Industrial chemistry of the fats and waxes, Bailliere, Tindall and Cox Publishers, London, 1943.

15AG006 HORTICULTURAL CROP PROCESS ENGINEERING 3 0 0 3

Course Objectives

- To know the physical and thermal properties of horticultural produces
- To acquire the knowledge on the theory, methods, and equipment for the various unit operations of processing of fruits and vegetables, spices, plantation crops and medicinal plants

Course Outcomes (COs)

1. Possess the knowledge on the different engineering properties of spicesand post harvest operations that are carried out to process the horticultural crops before they reach the consumers
2. Identify various parameters involved in packaging, grading, and quality analysis of spices
3. Apply the knowledge to choose suitable processing operation for coffee, tea, and coco
4. Explain post-harvest processing of coconut, oil palm, areca nut and cashew
5. Identify processing techniques for medicinal crops

UNIT I **12 Hours**

PROCESSING OF FRUITS AND VEGETABLES

Physical and thermal properties of fruits and vegetables-maturity indices for fruits-cleaning and grading of fruits and vegetables-electronic colour sorting of fruits and vegetables-unit operation of fruit processing-blanching of fruits and vegetables, thermal processing of fruit pulps-Controlled and Modified atmospheric storage and shrink film storage of fruits and vegetables.

UNIT II **12 Hours**

PACKAGING, GRADING AND QUALITY ANALYSIS OF SPICES

Spices – production and importance – stages of harvesting and harvesting methods – processing of major and minor spices – pepper, cardamom, chilli, turmeric, ginger, clove, nutmeg, vanilla – unit operations involved – equipment – principle and construction. Cleaning and grading of spices – packaging and storage of spices – grading specifications – Agmark, ASTA, ESA specifications – processes involved in the manufacture of oleoresins and essential oils –quality analysis of spices and their derivatives.

UNIT III **7 Hours**

PROCESSING OF COFFEE, TEA AND COCOA

Processing of coffee, tea, cocoa and rubber – methods, process and equipment – value added products –grading and types – packaging and storage.

UNIT IV **7 Hours**

PROCESSING OF COCONUT, OIL PALM, ARECA NUT AND CASHEW

Processing of plantation crops – production and importance – processing of coconut, oil palm, areca nut, cashew- harvesting and stages of harvest – drying, cleaning and grading – production of value added products – packaging and storage of produces.

UNIT V **7 Hours**

PROCESSING OF MEDICINAL CROPS

Importance of medicinal crops – production and export status – processing of medicinal crops – equipment used – principles and operations – active principles in various medicinal plants – application and uses – extraction methods.

FOR FURTHER READING

Processing of unexploited fruits

Total: 45 Hours

References

1. P. H. Pandey, Post-Harvest Engineering of Horticultural Crops through Objectives, Saroj Prakasam, Allahabad, 2002.
2. J.S. Pruthi, Major Spices of India – Crop Management and Post Harvest Technology, Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi, 1998.
3. ASTA, Official analytical methods of the American Spice Trade Association, Fourth Edition, 1997.
4. J.W. Purseglove, E.G.Brown, G.L.Green and S.R.J. Robbins, Cardamom – Chemistry, 1981. Spices, Vol. I, Tropical Agricultural Series, Longman, London, 1: 605.
5. J.S. Pruthi, Spices and Condiments: Chemistry, Microbiology and Technology, First Edition, Academic Press Inc, New York, USA, 1980.
6. Indian Journal of Arecanut, Spices & Medicinal Plants

15AG007 SUGAR TECHNOLOGY

3 0 0 3

Course Objectives

- To learn about the process of crystallization
- To understand the technology involved in the manufacture of sugar

Course Outcomes (COs)

1. Possess the knowledge on crystallization
2. Explain molasses conditioning and solids balance using Cobenze's diagram
3. Identify various processing steps in cane milling and identify equipment used for cane milling
4. Determine the role of centrifugal machine in sugar milling
5. Identify various processing steps and equipment in final sugar processing and utilise the knowledge if they take up a job in a sugar industry

UNIT I **9 Hours**

THEORY OF CRYSTALLIZATION

Theory of crystallization: Crystallization zones. Graining – Graining & Graining methods, Vacuum pan, types of pan, speed of circulation, heating surface to volume ratio, pan boiling techniques. Formula for size of slurry. Methods and preparation of slurry. False grain &conglomerates, Formation of false grain &conglomerates, causes of formation false grain &conglomerates

UNIT II **9 Hours**

MOLASSES

Molasses conditioning, precaution during molasses conditioning .Crystallization in motion. Details about crystallization in motion Solid balance, Solids balance by Cobenze's diagram. Types of carriers.

UNIT III **9 Hours**

CANE MILLING

Objective, Preparation index, bulk density method, sieving method, Leaching, method, judging by eye. Cane kicker or equiliser. Cane knives. Fibrizer anvil plate, hammers. Shredder. Mill Roller (Type, design). Key points of roller maintenance, Basic concept of pressure feeder. Imbibition– Importance, effect, types, method, Object of imbibitions, Imbibition efficiency

UNIT IV **9 Hours**

CENTRIFUGAL MACHINE IN SUGAR PROCESSING

Centrifugal machine, recycling self-discharging centrifugal machine 3 speed cycle, 4 speed cycle, Advantages and disadvantages of batch / continuous centrifugal machine.

UNIT V **9 Hours**

FINAL SUGAR PROCESSING STEP

Various parts regarding drying and cooling, rotary dryer, multitray gross hopper, fluidized bed hopper. Sugar Grader **–** Types of grader, dilution indicator, keeping quality factor safety factor. Sugar Dust collection system –Advantages and significance of dust collector, mechanism types. Sugar Godown **–** Location, stocking of sugar bags.

FOR FURTHER READING

Refining of sugar without sulphur treatment

Total: 45 Hours

References

1. Hand book of cane sugar –Meade &Chen
2. Manufacture of sugar from sugarcane –C. G. M. perk
3. Efficient Management for sugar factories –Mangal Singh
4. Cane sugar Manufacture in India, D.P. Kulkarni.

15AG008 BIO AND THERMO-CHEMICAL CONVERSION OF BIOMASS 3 0 0 3

Course Objectives

- To acquire the knowledge on the biomass characteristics and biochemical conversion technologies of biomass for energy generation
- To learn thermochemical conversion technologies for converting biomass into energy

Course Outcomes (COs)

1. Possess the knowledge on the biomass characteristics and biochemical conversion technologies of biomass for energy generation
2. Know about the thermochemical conversion technologies for converting biomass into energy

UNIT I **6 Hours**

BIOMASS CHARACTERIZATION

Biomass - types - fuels from biomass. Terms and units used in biomass production. Biomass fuel characterization - physical, chemical and thermal - energy release. Supply chain - harvesting / collection - transportation and processing. Briquetting - types – pelletizing

UNIT II **12 Hours**

BIOCHEMICAL CONVERSION

Biochemical degradation - factors affecting biogas production - types of biogas plants - construction details - operation and maintenance - utilization of biogas - slurry handling, utilization and enrichment - high rate biomethanation process - landfills - bioethanol - feedstock - process - utilization--composting - methods – machinery

UNIT III **8 Hours**

THERMO CHEMICAL CONVERSION BY COMBUSTION

Thermochemical degradation. stoichiometric air requirement - Combustion process - chemistry of combustion - combustion zones - emissions. Co firing of biomass. Incinerators - layout. Combustion of wastes and MSW. Wood burning stoves - types- operation

UNIT IV **11 Hours**

THERMOCHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS

Biomass gasification - chemistry of gasification - types of gasifier - Gas cleaning & conditioning - utilization of producer gas - emissions - commercial gasifiers. Pyrolysis - product recovery - types - biochar - bio oil - operation – recovery

UNIT V **8 Hours**

COGENERATION AND WASTE HEAT RECOVERY

Cogeneration technology - cycles - topping - bottoming - problems - applications - waste heat recovery. Carbon cycle- Carbon sequestration-CDM concept-CDM technologies-Carbon emission reduction calculation

FOR FURTHER READING

Biodiesel production technology-Sources for biodiesel production-methods-comparative evaluation of different methods

Total: 45 Hours

References

1. O.P.Chawla, - Advances in Biogas Technology, ICAR Publication, New Delhi, 1986
2. K.C. Khandelwal and S.S. Mahdi, Biogas Technology, Tata McGraw Hill Pub. Co. Ltd., New Delhi,1986
3. A.N. Mathur and N.S. Rathore, Biogas production Management and Utilisation, Himanshu Publications, New Delhi, 1993
4. Robert C Brown, Christian Steven (Editors), Thermochemical Processing of Biomass: Conversion into Fuels, chemical and powder, Wiley Eastern Publishers, 2011
5. Ashok Pandy, Thallada Baskar, M.Stocker and Rajeev Sukumaran (Editors), Recent advances in Thermochemical conversion of Biomass. Elsevier Publications, 2015
6. C.Higmen and M.Vander Burgt, Gasification, Elsevier Science, USA, 2003

15AG009 SOLAR AND WIND ENERGY

3 0 0 3

Course Objectives

- To learn about the fundamental aspects of solar energy availability, solar energy conversion technologies
- To understand about the fundamental aspects of wind energy availability and wind power generators
- To acquire the knowledge on the alternate sources of energy such as geothermal energy, wave energy, tidal energy, OTEC energy, fuel cells and energy storage

Course Outcomes (COs)

1. Possess the knowledge on the fundamental aspects of solar energy availability, solar thermal energy conversion technologies and solar PV power generation technology
2. Gain the knowledge on the fundamental aspects of wind energy availability and wind power generators
3. Possess the knowledge on the alternate sources of energy such as geothermal energy, wave energy, tidal energy, OTEC energy, fuel cells and energy storage

UNIT I **9 Hour**

SOLAR ENERGY RADIATION AND SOLAR THERMAL COLLECTORS

Solar radiation availability – radiation measurement – transmittance – absorptance – flat plate collectors – heat transfer correlations – collector efficiency – heat balance – absorber plate – types – selective surfaces. Solar driers – types – heat transfer – performance of solar dryers – agro industrial applications.

UNIT II **9 Hours**

SOLAR CONCENTRATING COLLECTORS AND PV TECHNOLOGY

Optically concentrating collectors – types – reflectors – solar thermal power stations – principle and applications – solar stills – types – solar pond – performance – characteristics – applications. Photovoltatics – types – characteristics – load estimation – batteries – invertors – operation – system controls. PV system installations – standalone systems – PV powered water pumping – system sizing and optimization – hybrid system – solar technologies in green buildings.

UNIT III **9 Hours**

WIND MAPPING ANALYSIS AND CHARACTERISTICS OF WIND

Nature of wind – wind structure and measurement – wind power laws – velocity and power duration curves – aero foil – tip speed ratio – torque and power characteristics power coefficients – Betz coefficient.

UNIT IV **9 Hours**

WIND MILL DESIGN AND APPLICATIONS

Turbines – Wind mill – classification – power curve. Upwind and downwind systems – transmission rotors – pumps – generators – standalone system – grid system – batteries. Wind energy storage – wind farms – wheeling and banking – testing and certification procedures.

UNIT V **9 Hours**

ALTERNATE ENERGY SOURCES

Ocean energy – off shore and on shore ocean energy conversion technologies – OTEC principles – open and closed cycles. Tidal energy – high and low tides – tidal power – tidal energy conversion. Geothermal energy – resources – classification and types of geothermal power plants. Nuclear energy – reactions – fusion, fission, hybrid reactors. Fuel cell – principle and operation – classification and types. Energy storage – pumped hydro and underground pumped hydro – compressed air – battery – flywheel – thermal.

FOR FURTHER READING

Latest developments in Battery storage-case studies in Solar PV power Installations

Total : 45 Hours

References

1. Mathew Buresch, Photovoltaics Energy Systems. McGraw-Hill Book Company, London 1986
2. Jui Sheng Hsieh, Solar Energy Engineering, Prentice Hall, London 1986
3. Tany Burtar, Handbook of wind energy, John Wiley and Sons, 2001
4. J.C. Mc Gowan. Manwell, J.F. and A.L.Rogers. Wind Energy Explained – Theory Design and Application, John Willey and Sons Ltd, 2004
5. H.P.Garg, Treatise on Solar Energy, Vol.1 & 2, John Wiley & Sons Ltd., 1982
6. G.D.Rai, “Solar Energy Conversion”, Khanna Publishers, New Delhi, 2002

15AG010 ENERGY CONSERVATION IN AGRO BASED INDUSTRY 3 0 0 3

Course Objectives

- To learn the different aspects of energy auditing in the Food Industry
- To know about the energy saving opportunities in existing food processing facilities

Course Outcomes (COs)

1. Possess the knowledge on different aspects of energy auditing in the Food Industry
2. Apply various energy conservation opportunities in Food Industries
3. Achieve energy saving through waste heat recovery and waste utilisation

UNIT I **12 Hours**

ENERGY AUDITING, SUSTAINABILITY IN THE FOOD INDUSTRY

Fundamentals of Energy Auditing,-Sustainability in the Food Industry -Energy Conservation Technologies Applied to Food Processing Facilities- Energy Conservation in Steam Generation and Consumption System. Energy Conservation in Compressed Air System- Energy Conservation in Power and Electrical Systems. Energy Conservation in Heat Exchangers

UNIT II **6 Hours**

WASTE HEAT RECOVERY

Waste Heat Recovery and Thermal Energy Storage in Food Processing Facilities- novel Thermodynamic Cycles Applied to the Food Industry for Improved Energy Efficiency

UNIT III **12 Hours**

ENERGY SAVING OPPORTUNITIES IN EXISTING FOOD PROCESSING FACILITIES

Energy Consumption pattern, Energy Conservation in Grains and Oilseeds Milling Facilities, in Sugar and Confectionary Processing Facilities, in Fruit and Vegetable Processing Facilities, in Dairy Processing Facilities, in Meat Processing Facilities, in Bakery Processing Facilities

UNIT IV **9 Hours**

ENERGY CONSERVATION IN EMERGING FOOD PROCESSING SYSTEMS

Membrane Processing of Foods, Energy Efficiency and Conservation in Food Irradiation, in Pulsed Electric Fields Treatment, in High-Pressure Food Processing, in Microwave Heating, in Supercritical Fluid Processing Conversion of Food Processing Wastes into Energy\

UNIT V **6 Hours**

FOOD PROCESSING WASTES AND UTILIZATIONS

Concepts of Anaerobic Digestion of Food Processing Wastes, Fermentation of Food Processing Wastes into Transportation Alcohols, Bio-diesel Production from Waste Oils and Fats, Thermo-chemical Conversion of Food Processing Wastes for Energy Utilization

FOR FURTHER READING

Case studies on Energy auditing of Food industries-industry visit-report preparation and presentation by the students through PPT in the class

Total: 45 Hours

References

1. L.Wang, Energy Efficiency and Management in Food Processing Facilities, CRC Press, 2009
2. R. P. Singh, Energy in Food Processing, Elsevier Publishing Co., 1986
3. B. Mattsson, and U. Sonesson, Environmentally Friendly Food Processing, CRC Press, 2003

15AG011 CO-GENERATION AND WASTE HEAT RECOVERY SYSTEMS

3 0 0 3

Course Objectives

- To gain the knowledge on Cogeneration and Waste Heat Recovery Systems
- To analyze the techno economic viability of various energy efficient systems

Course Outcomes (COs)

1. Possess the knowledge on the basic thermodynamic principles of cogeneration and the cogeneration technologies based on steam turbine, gas turbine and IC engines
2. Utilise waste heat recovery systems, economic analysis and environmental considerations in industries

UNIT I **6 Hours**

INTRODUCTION

Cogeneration principles and definition-thermodynamics power cycle analysis-Rankine and Brayton cycles- topping and bottoming cycles

UNIT II **10 Hours**

COGENERATION SYSTEMS

Performance indices of cogeneration systems- Cogeneration systems based on steam turbine, gas turbine, combined cycle, and IC engines- Cogeneration systems based on Stirling Engines

UNIT III **10 Hours**

APPLICATIONS OF COGENERATION

Applications in sugar mills, rice mills, textile factories, and other process and engineering industries- Impacts of cogeneration plants- fuel- electricity

UNIT IV **10 Hours**

WASTE HEAT SOURCES

Selection criteria for waste heat recovery technologies. Recuperative and regenerative heat exchangers for waste heat recovery. Waste heat boilers- classification- design considerations- sizing- location- performance calculations. Heat pumps - types- design

UNIT V **9 Hours**

COST ANALYSIS AND ENVIRONMENTAL IMPACT OF COGENERATION SYSTEMS

Economic analysis of cogeneration and waste heat recovery systems. Regulatory and financial framework for cogeneration and waste heat recovery systems. Environmental considerations- mitigation of harmful emissions from energy production- conversion and utilization technologies- control of air, water and ground pollution

FOR FURTHER READING

Case studies on Cogeneration-visit to industries-report preparation and presentation by students in the class through PPT

Total: 45 Hours

References

1. Charles H.Butler, Cogeneration , McGraw Hill Book Co, 1984
2. Y.H. Kiang, Waste Utilization Technology, Marcel Dekker Inc, 1981
3. David Hu and Gerald HRD, Waste recycling for Energy Conservation, John Wiley and Sons, New York,1981
4. Sydney Reiter, Industrial and Commercial Heat Recovery Systems, Van Nostrand Reinhold, 1985
5. Spiewak Scott A, Cogeneration and Small Power Production Manual, The Fairment Press, 1987
6. Khartchenko N.V. Green Power: Eco-Friendly Energy Engineering, Tech Books, New Delhi, 2004.

15AG012 PROTECTED CULTIVATION

3 0 0 3

Course Objectives

- To impart knowledge on the protected cultivation of vegetables, fruits and flower crops.
- To sensitize the students on hi-tech production technology of fruits, vegetables and flower crops.

Course Outcomes (COs)

1. The students will be able to describe the different methods of protected cultivation practices available for vegetable crops and flowers
2. The students will be able to assess the technology available for vegetable crops
3. The students will be able to assess the technology available for flower crops
4. The students will be able to assess precision farming techniques using sensors and Geographic information systems for the crops
5. The students will be able to assess the technology available for horticulture crops

UNIT I **9 Hours**

PROTECTED CULTIVATION AND ITS TYPES

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 **9 Hours**

PROTECTED CULTIVATION OF VEGETABLE CROPS

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 **9 Hours**

PROTECTED CULTIVATION OF FLOWER CROPS

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 **9 Hours**

PRECISION FARMING TECHNIQUES

Concept and introduction of precision horticulture: 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 in horticultural crops, role of commuters in developing comprehensive systems needed in site specific management (SSM), georeferencing and photometric correction. Sensors for information gathering, geostatistics, robotics in horticulture, postharvest process management (PPM), remote sensing, information and data management and crop growth models, GIS based modeling.

UNIT V **9 Hours**

PRECISION FARMING OF HORTICULTURAL CROPS

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.

FOR FURTHER READING

Design of green house roof trusses, sorting, grading and packing of fruits, vegetables and flowers, and their transportation to market.

Total : 45 Hours

References

1. Lyn. Malone, Anita M. Palmer, Christine L. Vloghat Jach Dangeermond. Mapping out world: GIS lessons for Education, ESRI press, 2002
2. David Reed, Water, media and nutrition for green house crops. Ball publishing USA, 1996
3. Adams, C.R. K.M. Bandford and M.P. Early, Principles of Horticulture, CBS publishers and distributors, Darya ganj, New Delhi, 1996

15AG013 WATERSHED PLANNING AND MANAGEMENT 3 0 0 3

Course Objectives

- To acquire the fundamental understanding of watershed planning and management
- To develop skills on water conservation and harvesting
- To prepare watershed development plans and cost estimate

Course Outcomes (COs)

1. The students will able to describe the watershed management concepts
2. The students will able to describe the components involved in watershed planning
3. The students will able to describe the methods of water harvesting structures
4. The students will able to design and construct the soil conservation structures
5. The students will able to prioritize and execute the watershed development programme

UNIT I **9 Hours**

INTRODUCTION

Watershed Management concepts leading to control of quality and quantity of runoff, Geomorphology of watersheds. Problems and Prospects in Watershed Management. Land Capability and its Classification, Watershed Based Land Use Planning. Watershed Characteristics: Classification and Measurement, Importance of Watershed Properties for Watershed Management.

UNIT II **9 Hours**

HYDROLOGIC DATA FOR WATERSHED PLANNING

Importance of Watershed Planning, Utility of Hydrologic Data in Watershed Planning. Watershed Delineation, Prioritization of Watersheds. Water Yield, Measurement of Water Yield from Watersheds. Hydrologic and Hydraulic Design of Recharge Structures, Design of Earthen Embankments and Diversion Structures.

UNIT III **9 Hours**

WATER MANAGEMENT

Water harvesting in-situ and reservoirs. Preparation of water harvesting catchments. Common water harvesting techniques. Seepage control in reservoir. Construction of reservoirs/ponds and bunds. Control of evaporation from reservoirs.

UNIT IV **9 Hours**

SOIL EROSION AND ITS CONTROL MEASURES

Problem /Types of Water Induced Soil Erosion & Measures for its Control, Problem/ Types of Wind Induced Soil Erosion & Measures for Control. Measurements of Sediment Yield, Estimation and Modeling of Sediment Yield. Rainwater Conservation Technologies, Design of Water Harvesting Structures. Watershed Land Use/Land Cover, Effect of Land Use Land Cover on Watershed Hydrology.

UNIT V **9 Hours**

PROJECT PLANNING METHODS

Preparation of project plans. Preparation reports, Cost benefit analysis. Methodologies to encourage people's participation.

FOR FURTHER READING

Optimal Land Use, Case Studies on Optimal Land Use. Need for People's Participation in Watershed Management, Case Studies in People's Participation in Watershed Management.

Total : 45 hours

References

1. All India Soil and Land Use Survey (AISLUS), Watershed Atlas of India, All India Soil and Land Use Survey, Ministry of Agriculture, Government of India, New Delhi, India, 1990
2. K.N.Brooks, P.F.Ffolliott and J.A.Magner, Hydrology and the management of watersheds, Fourth Edition, Wiley-Blackwell, 2013
3. United States Environmental Protection Agency (USEPA), Handbook for developing watershed plans to restore and protect our waters, USEPA, 2008
4. A.Agarwal, Drought, Try Capturing the Rain, Occasion paper, Centre for Science and Environment, New Delhi, 2000
5. A.S.Patel and D.L.Shah, Water Management, New Age International Publishers, 2008

15AG014 RESERVOIR AND FARM POND DESIGN 3 0 0 3

Course Objectives

- To acquire the fundamental understanding of reservoir and farm ponds
- To develop skills on design and construction of farm ponds and reservoirs
- To analyse the economics of farm ponds and reservoirs

Course Outcomes (COs)

1. Able to describe the principle of rainwater harvesting structures and dams
2. Able to design and construct reservoir and farm ponds
3. Able to evaluate the operation and maintenance of water harvesting structures
4. Able to investigate the economic indicators of farm pond and reservoir
5. Able to describe water quality Harvested Water and Environmental Consideration

UNIT I **9 Hours**

FUNDAMENTALS OF RESERVOIR AND FARM PONDS

Introduction to Rainwater Harvesting, Hydrological Aspects of Water Harvesting, Identification of Areas Suitable for Water Harvesting, Reservoir/Dam and Farm Ponds, Earthen Embankments, Earthen Embankment Classification.

UNIT II **9 Hours**

BASIC DESIGN ASPECT OF RESERVOIR AND FARM POND

Components of Embankment, Basic Design Concept, Design of Dam Components. Seepage through Dam, Estimation of Seepage Flow, Determination of Location of Seepage Line, Flow Net, Seepage Analysis I, Seepage Analysis II, Failure and Damages I, Failure and Damages II, Control of Seepage Using Drainage System, Stability Analysis I, Stability Analysis II, Stability Analysis III, Stability Analysis IV, Slope Protection.

UNIT III **9 Hours**

CONSTRUCTION OF RESERVOIR AND FARM PONDS

Construction, Operation and Maintenance of Water Harvesting System.

UNIT IV **9 Hours**

ECONOMIC ANALYSIS OF FARM POND AND RESERVOIR

Introduction to Economic Analysis, Economic Indicators

UNIT V **9 Hours**

MISCELLANEOUS ASPECTS ON RESERVOIR AND FARM POND

Water Quality of Harvested Water and Environmental Considerations, Method to Reduce Seepage and Evaporation Losses, Runoff Inducement Methods, Other Water Harvesting Structures.

FOR FURTHER READING
Design a Farm pond

Total: 45 Hours

References

1. Critchley, W, Siegert, K, A Manual for the Design and Construction of Water Harvesting Schemes for Plant Production, Food and Agricultural organization, 1991
2. Owesis, T. Y., Prinz, D. and Hachum, A. Y, Rainwater harvesting for agriculture in the dry areas. CRC Press publication, 2012
3. Garg, S. K, Irrigation Engineering and Hydraulic Structures. Twenty fourth Revised Edition, 2011
4. Suresh, R, Soil and Water Conservation Engineering. Standard Publishers,2002
5. Garg, S. K. Irrigation Engineering and Hydraulic Structures. Twenty Fourth Revised Edition, pp.811-814, 2011
6. Critchley, W., C. Reij, and A. Seznec, Water Harvesting for Plant Production. Volume II: Case Studies and Conclusions for Sub-Saharan Africa. World Bank Technical Paper No. 157,1992

15AG015 HARVESTING AND THRESHING MACHINERY

3 0 0 3

Course Objectives

- To learn the applications and right choice of harvesting and threshing machinery for different crops
- To develop skills on safe and efficient use of harvesting and threshing machinery

Course Outcomes (COs)

1. Possess the knowledge on harvesting and threshing machines
2. Identify and rectify the functioning of harvesting threshing machines
3. Learn about the machines and techniques used for harvesting and threshing
4. Operate and maintain harvesting machinery
5. Possess skills on the safe and efficient use of threshing machinery

UNIT I **9 Hours**

HARVESTERS

Principles and types of cutting mechanisms. Harvesters - types - mowers- mechanism - construction and adjustments - registration and alignment. windrowers, reapers, reaper binders and forage harvesters. Self-Propelled Walking Type Vertical Conveyor Reaper-self-propelled Fodder Harvester (Cutter bar Type)- Tractor Front Mounted Vertical Conveyor Reaper- Tractor Mounted Fodder Harvester- Tractor Mounted Root Crop Harvester cum Elevator- Tractor Operated Groundnut Digger Elevator- Tractor Operated Cassava Harvester- Tractor Drawn Turmeric Digger- Tractor Operated Potato Digger Elevator

UNIT II **9 Hours**

THRESHERS

Threshing principle - manual and power threshing - types of power thresher-hammer-mill , rasp bar, spike-tooth cylinder and drum types-cleaning-threshing efficiency- Pedal Operated Thresher-power operated paddy threshing and winnowing machine- power wheat thresher- groundnut thresher-precautions and care in the operation of threshers- construction and working of multi crop thresher - advantages- Power operated axial flow sunflower thresher- maize thresher

UNIT III **9 Hours**

COMBINE HARVESTERS

Combine harvester - advantages-types - parts - construction and working-japanese type paddy combine. Sugarcane harvesters-parts-construction and working. Corn harvesters and shellers

UNIT IV **9 Hours**

FRUIT HARVESTERS

Fruit pluckers - tree shakers - fruit harvesting machinery. Tractor operated banana clump remover-Self-propelled Platform Type Fruits Harvesting System

UNIT V **9 Hours**

OTHER MACHINERY

Groundnut-cum-Castor Decorticator- Tractor or Electric Motor Operated Multi-crop thresher for seed spices- tree climber- cotton pickers - tractor operated garlic harvester-aerial access hoist for management of coconut and tall trees. Forest machinery - shrub cutters - tree cutting machines - post hole diggers - Chaff cutter.ISI specifications for various implements and agricultural machinery-testing procedures for various implements

FOR FURTHER READING

Testing Procedure of Tillage Equipment, Agricultural Machinery and equipment -BIS and RNAM test codes of agricultural machines

Total: 45 Hours

References

1. Harris Pearson Smith and Lambert Henry Wilkes, Farm machinery and equipment, 6th edition, Tata McGraw-Hill, New Delhi, 1990.
2. Robert Allen Kepner, Roy Bainer, Edgar Lee Barger, Principles of farm machinery, AVI Publishers, 1978.
3. Lal, Radhey and A.C. Dutta, "Agricultural Engineering through solved examples", Saroj Prakashan Publishers, Allahabad, 1971.

15AG016 MECHANICS OF TILLAGE AND TRACTION

3 0 0 3

Course Objectives

- To impart the fundamental knowledge of mechanics and dynamics in various tillage implements
- To study the tyres, traction and its applications

Course Outcomes (COs)

1. Possess the knowledge on tillage and traction
2. Possess the knowledge on soil trafficability
3. Know the forces acting on tillage tool
4. Understand the concepts of mechanics of tillage equipment and traction of implements
5. Know the design of tillage equipment and their applications

UNIT I **9 Hours**

MECHANICS OF TILLAGE

Introduction to mechanics of tillage tools, forces acting on tillage tool- engineering properties of soil, principles and concepts, stress strain relationship- Mohr’s circle- stress- soil failures- stress and strain in soil-stress distribution-strain distribution-yield in soil.

UNIT II **9 Hours**

DYNAMICS OF TILLAGE

Design of tillage tools principles of soil cutting, design equation, force analysis, application of dimensional analysis in solid dynamics performance of tillage tools-dynamic properties of soil-adhesion –cohesion- dynamic versus static properties- vane shear apparatus-triaxial shear apparatus.

UNIT III **9 Hours**

TRACTION

Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction-rolling resistance-wheel slip-traction aid- mechanics aof traction and transport- nonrolling traction devices-rolling traction devices- evaluating traction performance.

UNIT IV **9 Hours**

TYRES

Agricultural tyres -types-Tyre size, tyre lug geometry and their effects, tyre testing- pressure-aspect ratio- oil compaction in tillage and traction-compaction behavior equations- vehicle morphology-vehicle capabilities.

UNIT V **9 Hours**

APPLICATIONS

Soil compaction and plant growth, variability and geo statistics, application of GIS in soil dynamics-the shape of contact surface-transport devices-driven wheels-tracks- auxiliary devices-operational control of design factors-vehicle on traction and transport capabilities.

FOR FURTHER READING

Analysis on the force requirement of different tillage tools

Total : 45 Hours

References

1. Ralph Alcok, Tractor Implements System, AVI Publs, 1986.
2. Jain S. C. and Philip Grace, Farm Machinery - an approach, Standard Publisher and Distributor, New Delhi, 2003.

15AG017 PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY 3 0 0 3

Course Objectives

- To acquire an in-depth knowledge on the production technology of Agricultural machinery
- To develop skills on safe and efficient use of relevant materials for less cost and high efficiency
- To acquire knowledge on the test procedures to assess the performance agricultural machinery

Course Outcomes (COs)

1. Possess the knowledge on production technology of agricultural machinery
2. Know the material of construction of individual components
3. Identify and rectify the functioning of agricultural machineries.
4. Choose the right material for the manufacture of different components of farm machinery and implements
5. Prepare industry lay out and serve as quality managers in industries

UNIT I **9 Hours**

INTRODUCTION TO PRODUCTION OF AGRICULTURAL MACHINERY

Status of agricultural machinery in Tamil Nadu and India-problems faced in the manufacture of agricultural machinery-requirements of industries-Critical appraisal- agricultural machinery manufacturing industries in Tamil Nadu-India.

UNIT II **9 Hours**

ADVANCES IN MATERIAL FOR TRACTOR AND AGRICULTURAL MACHINERY AND MANUFACTURING TECHNIQUES

Material used for tractor and agricultural machinery, cutting tools, cutting tools for CNC machines, cutting tools for finishing operations. Advanced manufacturing techniques, electrical discharge machining, powder metallurgy. Heat treatment of steel, pack carburizing, shot peening, chemical vapour deposition (CVD).

UNIT III **9 Hours**

INDUSTRIAL LAY OUT PLANNING AND QUALITY MANAGEMENT

Limits, fits and tolerance, micro structure analysis of metals, industrial layout planning and quality management- Application to farm machinery scheduling problem. Application to farm – factory co-ordination – case study.

System engineering function, management and problems System analysis. Role of a system analyst in design of a system and development of computer systems. Characteristics of Agricultural systems. Tools of structured analysis.-The data flow model. Object oriented approach. System design process – structured design.

UNIT IV **9 Hours**

THE ROLE OF CAD IN AGRICULTURAL ENGINEERING

Application to farm machinery scheduling problem. Application to farm – factory co-ordination – case study. Design of farm machinery with the help of CAD. Practicals on CAD software, its uses and application in design of farm machinery. Design procedures. Exercise on agricultural engineering system analysis. Description of the machinery scheduling problem in harvesting and transport system. Investigation of existing software models – cases studies.

UNIT V **9 Hours**

ECONOMICS OF PROCESS

Economics of process selection. Techno economic feasibility of project report, case study on agricultural tines, case study of manufacturing of weeders, critical components and their selection. Feasibility study – Steps in feasibility analysis – cost analysis.

FOR FURTHER READING

Case study on manufacturing aspects of agricultural machinery and implements by visiting industries

Total: 45 Hours

References

1. J.M. Shippen, C.R.Ellin and C.H. Clover, Basic farm machinery, Pergamon Press Ltd, 1987.
2. C.J. Studman, Agricultural and horticultural engineering, Butterworths PVT Ltd, 1990.
3. R.N. Kaul, and C.O. Egbo, Introduction to Agricultural Mechanisation, Macmillan, London, 1985.
4. S. Nath, Manual of Practicals in Farm Mechanisation, Unitech Printery, 1988.
5. C.P. Crossley, and J. Kilgour, Small Farm Mechanisation for Developing Countries, Wiley, London, 1983.
6. FAO - Elements of Agricultural Machinery (Vol 1 - 11). Agricultural Service Bulletin No.12, 1977.

15AG018 HUMAN ENGINEERING AND SAFETY 3 0 0 3

Course Objectives

- To know about the importance of ergonomics
- To design agricultural machinery, equipment, implements and tools that suits comfort for work
- To know about the safety in design and operation of agricultural machinery

Course Outcomes (COs)

1. Possess the knowledge on the importance of ergonomics and its application in agriculture
2. Possess the knowledge on human engineering
3. Design ergo refined agricultural machinery.
4. Know the test procedures to take anthropometric data and measurement techniques
5. Apply the safety standards at work place during various farm operations

UNIT I **8 Hours**

INTRODUCTION

Importance of ergonomics and its application agriculture; Human: physiology, digestion and absorption of foodstuff, liberation and transfer of energy. Concept of indirect, calorimetry, physiological responses and techniques of their measurements. Energetic efficiency of muscular work

UNIT II **9 Hours**

ANTHROPOMETRY AND BIO-MECHANICS

Structural and functional body dimensions, Instrumentation and their methods of measurement, Analysis and application of anthropometric data. Visual displays; Process of seeing, Horizontal and Vertical fields of hand, Colour discrimination, Quantitative and qualitative visual displays, signals and warning lights

UNIT III **9 Hours**

DESIGN OF CONTROLS AND WORK SPACE ENVELOPE

Functions of controls, Identification of Controls. Design aspects of hand and foot controls mainly. Steering, clutch, accelerator, brake and pedal design of tractors. Arrangements of controls, work-space envelope. Analysis and design of job requirements. Work physiology in agriculture. Scaling of physiological work. Fatigue allowance and indices, shift work, work-rest scheduling

UNIT IV **10 Hours**

PHYSIOLOGICAL FACTORS AFFECTING OPERATOR, MACHINE PERFORMANCE

Limitations of human in relation to stresses and demands of working environments. Thermal: heat exchange process and coefficients, physiological mechanics of heat regulation, management of temperature problems, work load and allowance in hot environment. Mechanical: noise and loss of hearing, physiological effects acceptable limits, handling of noise problems, ear protection devices. Vibration: sources of vibration, effects in physiological responses control of vibration on agricultural equipment. Illumination: nature and measurement of light, colour systems, amount of illumination, roadway features influencing visibility, vehicle light

UNIT V **9 Hours**

POSTURAL COMFORT AND OPERATOR SAFETY

Problems of posture and comfort. Science of seating cushion functional requirements, static and dynamic compatibility of operator-seat machine. Engineering principles applied to industrial and agricultural safety. Road, accidents, road signs and accident prevention. Safety symbols and signs, hand signals, colour codes for agricultural equipment.

FOR FURTHER READING

Analysis of case studies on ergonomic study of different farm implements and machinery

Total: 45 Hours

References

1. Sanders,M.S. and McComack,EJ. Human factors in Engineering and Design. Tata McGraw Hill, New York, 1992
2. Obome, David.J. Engieering Work. John Wiley and Sons Ltd., 1982
3. Astand, P.P. and Rodaid,K. Text book of Work Physiology, McGraw Hill Book Company, New York, 1970
4. Grandjean,E. Fitting the Track of the Man, Taylor and France Ltd., U.K.,1981

15AG019 DISASTER MANAGEMENT 3 0 0 3

Course Objectives

- To provide students an exposure to disasters, their significance and types
- To ensure that students understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR) and to respond to potential disaster in their surroundings with due sensitivity

Course Outcomes (COs)

1. Differentiate the types of disasters, causes and their impact on environment and society
2. Assess vulnerability and various methods of risk reduction measures as mitigation.
3. Draw the hazard and vulnerability profile of India, disaster damage assessment and management.

UNIT I **9 Hours**

INTRODUCTION TO DISASTERS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of Disasters – Earthquake, Landslide, Food, 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 **9 Hours**

APPROACHES TO DISASTER RISK REDUCTION (DRR)

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 **9 Hours**

INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

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.

UNIT IV **9 Hours**

DISASTER RISK MANAGEMENT IN INDIA

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 **9 Hours**

DISASTER MANANGEMENT : APPLICATIONS AND CASE STUDIES AND FIELD WORKS

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

FOR FURHTER READING

Case study -Tsunami effect

Total : 45 Hours

References

1. Govt. of India : Disaster Management Act, Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009

15AG020 CLEAN DEVELOPMENT MECHANISM (CDM) AND CARBON TRADING **3 0 0 3**

Course Objectives

- To know the basics, importance of clean development mechanism **(CDM)**
- To know the concept of carbon trading

Course Outcomes (COs)

1. Demonstrate an understanding of clean development mechanisms adopted in developing and developed countries
2. Know about the procedures involved in the implementation of CDM projects
3. Calculate the carbon credits of energy production processes in terms of Certified Emission reduction(CER)

UNIT I **9 Hours**

GREEN HOUSE GASES AND ENVIRONMENTAL CHANGE

Global Environmental changes-United nations framework convention on climate change-United (UNFCC)-ozone layer depletion –land degradation-air and water pollution-sea-level rise-loss of biodiversity-climatic change problem GHG emissions by different countries-developing country responsibilities - India's Greenhouse gas emissions - The conference of parties.

UNIT II **9 Hours**

KYOTO PROTOCOL AND CDM PROJECTS

Kyoto protocol and clean development mechanism- CDM and cooperative mechanism-CDM overview administration –participation –CDM institutions-procedures CDM project cycle-project design and formulation – eligibility-additionally. Approval of (DNA) Designated National Authority. Validation and registration-monitoring-validation and certification through the source of Certified Emission Reduction(CER).

UNIT III **9 Hours**

TYPES AND FEATURES OF CDM

Types of CDM-topology -project activity -small scale CDM project categories- accesstation and cater station projects. PDO- project design document –General description of project activity- baseline methodology-monitoring methodology-auditing period-technical aspects.

UNIT IV **9 Hours**

MONITORING OF CDM

Monitoring and verification-verification process principles of verification-report preparation-pitfalls. Joint implementation (JI)-institutions and procedures-guidelines-JI or small scale projects-JI Land Use, Land Use Change and Forestry (LULUCF) projects.

UNIT V **9 Hours**

SUSTAINABLE ENERGY DEVELOPMENT

Low carbon technologies-low carbon building-alternative approaches-energy efficiency projects-sustainable energy policy concepts-mitigating energy related GHG emissions through renewable energy-carbon trading.

FOR FURTHER READING

Case studies on Clean development mechanisms and preparation of sample CDM projects

Total: 45 Hours

References

1. CDM Manual for project developers and policy makers-UNFCCC Publication, 2007
2. Myungkyoon Lee, Information and Guide Book - the UNEP project CD4CDM-UNEP publication, June 2004.
3. MyungKyoon Lee, Baseline Methodologies for clean Development Mechanism Projects- A Guide Book-Vol.1, UNEP publication, 2005.
4. MyungKyoon Lee, Baseline Methodologies for clean Development Mechanism Projects- A Guide Book-Vol.2, UNEP publication,2005.
5. Aukland L, Bass S, Hug S, Landell – Mals N, Tipper R, Laying the Foundations for clean Development, Preparing the Land use sector London, 2002.
6. Carbon sequestration in dryland soils, World Soil Resources report No.102, Food and Agriculture Organization, Rome,2004.

15AG021 CLIMATE CHANGE AND ADAPTATION

3 0 0 3

Course Objectives

- To know the basics, importance of global warming
- To know the concept of mitigation measures against global warming
- To learn about the global warming and climate change

Course Outcomes (COs)

1. Demonstrate an understanding of how the threats and opportunities of predicted climate changes will influence specific sectors at global and regional scale;
2. Critically evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts;
3. Understand and critically evaluate the scientific insights underlying the assessment reports of the IPCC, with a focus on impacts, adaptation and mitigation.

UNIT I **9 Hours**

EARTH'S CLIMATE SYSTEM

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

UNIT II **9 Hours**

ATMOSPHERE AND ITS COMPONENTS

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 **9 Hours**

IMPACTS OF CLIMATE CHANGE

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 Scenarious – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV **9 Hours**

OBSERVED CHANGES AND ITS CAUSES

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 – on a Global Scale and in India.

UNIT V **9 Hours**

CLIMATE CHANGE AND MITIGATION MEASURES

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) – Municipal solid Waste (MSW) & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

FOR FURTHER READING
Sequestration of carbon through renewable energy technologies

Total: 45 Hours

References

1. Adaptation and mitigation of climate – 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

15AG022 AGRICULTURAL MARKETING 3 0 0 3

Course Objectives

- To expose the students to know about marketing the Agricultural products from the point of production to the point of consumption / utilization

Course Outcomes (COs)
After completion of this course, the students will be

1. Understanding the market conduct and functions
2. Familiar with various market channels and prices
3. Able to understand marketing institutions
4. Trained in Agricultural products trading
5. Familiar with product prices and risk management

UNIT I **9 Hours**

MARKET STRUCTURE CONDUCT AND PERFORMANCE
Components: Dynamics of Market Structure, Agricultural Marketing and Economic Development, Marketing Functions and their Classification, Marketing Agencies: Producers, Middlemen, Retailers, Commission Agents, Brokers, Advertising Agency: Marketing Institutions.

UNIT II **9 Hours**

MARKETING CHANNELS, MARKETING COST, MARKETING EFFICIENCY AND MARKET INTEGRATION
Marketing Channels: Factors affecting Marketing Channels; Marketing Channels for various products, Innovative Marketing Channels, Market Integration: Types, Marketing Cost in India, Reducing Marketing Cost, Relationship of Farmer's Price and Consumer's Price

UNIT III **9 Hours**

COOPERATIVE AGRICULTURAL MARKETING INSTITUTIONS
Functions: Types, Single Commodity Multi Commodity, Multi purpose, Multi commodity Structure; Membership: Sources of Finance, Functioning, Cooperative Processing, NAFED, NCDC, NDDB, TANFE

UNIT IV **9 Hours**

EXTERNAL TRADE IN AGRICULTURAL PRODUCTS
Trade Policy for Agriculture: Share of Agricultural Products in Total Imports/Exports of India, Changes in India's Agricultural Export Basket, Recent Policies on Trade, GATT (The General Agreement on Trade and Tariffs), World Trade Organization (WTO).

UNIT V **9 Hours**

AGRICULTURAL PRICES AND RISK MANAGEMENT

Commission for Agricultural Costs and Prices (CACP): Price Policy, risks-minimization of risk, Future Trading, Dangers of Forward Market, Contract Farming/Contract Marketing**.**

FOR FURTHER READING

Case studies on regulated markets for agricultural commodities

Total : 45 Hours

References

1. Acharya S.S and N.L. Agarwal. 2012. Agricultural marketing in India. Oxford and Ibh publishing co.pvt.Ltd., New Delhi
2. Agricultural Marketing in Tamil Nadu, Department of Agricultural Marketing, Government of Tamil Nadu, Chennai, 2000.
3. Khols, R.L. and Damey, Marketing of Agricultural Products, McMillan Company, New York, 1972.
4. Wader, L.K. 2013.Text Book of Agricultural Marketing and Cooperation. ICAR New Delhi

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www.agriwatch.com
www.icar.org.in / en / agricultural - extension.html
www.gropedia.iitk.ac.in
www.agricoop.nic.in
www.agmarknet.nic.in

15AG023 PLANT PROTECTION 3 0 0 3

Course Objectives

- To impart basic knowledge of insect pest and diseases and their losses caused to crops.
- To study various methods of plant protection to get more yield in Agricultural and Horticultural crops.

Course Outcomes (COs)

1. Possess knowledge on various groups of insect pests and diseases of crops and their symptoms of damage.
2. Acquire knowledge on different crops damaged by insects and diseases
3. Possess knowledge on various methods of pest management to increase crop yield.
4. Posses knowledge on plant protection machineries.
5. Understand pesticide residues and health hazards; integrated pest and disease management in organic/inorganic farming.

UNIT I **9 Hours**

GROUPS OF INSECT AND DISEASE

Sucking pests, borer pests, soil pests, Vectors, Rodent pests and their symptoms of damage. Fungal bacterial and viral pathogens causing crop diseases.

UNIT II **9 Hours**

AGRICULTURE AND HORTICULTURE CROP PESTS

Agricultural crops: Rice, pulses cotton, sugarcane. Horticultural crops: Coconut, fruits, vegetables and flower crops affected by various pests and diseases.

UNIT III **9 Hours**

METHODS OF CROP PROTECTION

Cultural, physical, mechanical, legal, biological, chemical and biotechnological methods of crop protection and IPM.

UNIT IV **9 Hours**

PLANT PROTECTION APPLIANCES

Different machineries available for spraying / soil application on annual and perennial crops and maintenance of machineries.

UNIT V **9 Hours**

PESTICIDE HAZARDS AND MANAGEMENT

Pesticide residues in consumable crop parts by way of application of pesticides / fungicides; methods of decontamination of toxic chemicals; organic healthy way of crop protection.

FOR FURTHER READING

Mode of spread of pest and diseases, prophylactic measures to manage pests mode of action of pesticides, complex problems in plant protection

Total : 45 hours

References

1. Dhandapani, N and S.Uthamasamy 2000. Integrated pest Management. Tnau Publications, Coimbatore.p.181.
2. Justin. K.2004. Crop protection. TNAU, Petchipaarai, kanyakumari Dt.p.379.
3. Ragupathy. A and R. Ayyasamy 2003. A Guide on crop pests. Namrutha publications, Madananadapuram, Porur, Chennai-16.p.368.
4. Research and development section, Nagpur 1998. Pesticides in India. Agri-Horticultural publishing House Nagpur 440010.p.382.
5. Arjunan. G. 1999. Disease of Horticultural crops. Dept.of plant pathology, TNAU, Coimbatore.p.399.
6. David, B.V. and T. kumaraswami 1975. Elements of Economic Entomology. Popular Book Depot, Chennai-600034.p.507.

15AG024 EMERGING TECHNOLOGIES IN FOOD PROCESS ENGINEERING 3 0 0 3

Course Objectives

- To understand the different emerging technologies in processing food.
- To familiarize about the equipments used for the processing of foods by emerging technologies
- To understand about alternate thermal and non thermal processing techniques

Course Outcomes (COs)

1. Possess the knowledge on application of High pressure processing and pulsed electric field processing
2. Possess the knowledge on application of pulsed electric field processing
3. Possess the knowledge on the importance of irradiation
4. Possess the knowledge on non thermal processing techniques
5. Possess the knowledge on thermal processing techniques

UNIT I **9 Hours**

HIGH PRESSURE PROCESSING

Principles: Mechanism and applications of high pressure processing to food systems; High pressure processing of salads, meats and sea foods, fruits and fruit products; Effect of high pressure on microorganisms, enzymes, textural and nutritional quality of foods; Other applications of high pressure processing; High Pressure Freezing: principles and equipment, types of high pressure freezing process, microbiological and enzymatic inactivation after high pressure freezing.

UNIT II **8 Hours**

PULSED ELECTRIC FIELDS PROCESSING

Principles, Mechanism, PEF treatment systems, Main processing parameters; PEF technology: Equipments, Applications; Mechanisms of microbial and enzyme inactivation. PEF processing of solid foods, liquid foods and beverages. Food safety aspects of pulsed electric fields.

UNIT III **8 Hours**

FOOD IRRADIATION

Introduction: Fundamentals of food Irradiation, Type and sources of radiation, dosimetry, mode of action of ionizing radiation; Direct and indirect effect, radiation effect on food constituents, Dose requirement for different products and regulations.

UNIT IV **14 Hours**

ALTERNATIVE NON THERMAL PROCESSING TECHNIQUES

High intensity pulsed light technology: principles of PLT technology, Technological aspects of PLT, Effects of PLT technology on microorganisms and food quality. Ultrasound Processing: Principle of ultrasound, Fundamentals, Ultrasound as a processing and food preservation tool, Effect of ultra sound on properties of foods, Applications of ultrasound in microbial inactivation, assisted drying, extraction, osmotic dehydration, detection of foreign bodies, filtration and freezing, challenges in ultrasound processing. Radio frequency electric fields: Introduction, radio frequency electric fields equipments, effect of radio frequency electrical field on inactivation of microorganisms.

UNIT V **6 Hours**

ALTERNATIVE THERMAL PROCESSING TECHNIQUES

Microwave heating and microwave drying: Microwaves, dielectric properties of foods, thermal properties of foods, Recent developments in microwave heating, combined microwave-vacuum drying, microwave freeze-drying, applications; Radio-frequency processing: Introduction, dielectric heating, Radio-Frequency applications for heating and drying.

Total: 45 Hours

Reference(s)

1. Emerging Technologies for Food Processing. Da-Wen Sun (Ed), Academic Press, 1st Edition, 2005.
2. Novel Food Processing Technologies. M. P. Cano, M. S. Tapia, and G. V. BarbosaCanovas, CRC Press, 1st Edition, 2004.
3. Maria Laura Passos, Claudio P. Ribeiro, Innovation in Food Engineering: New Techniques and Products, CRC press, 2010.
4. Howard Q. Zhang, Gustavo V. Barbosa-Canovas, V. M. Balasubramaniam, C. Patrick Dunne, Daniel F. Farkas, James T. C. Yuan, Nonthermal Processing Technologies for Food, 2000
5. Enrique Ortega-Rivas, Non-thermal Food Engineering Operations. Springer, 2012
6. Amit K. Jaiswal, Food Processing Technologies: Impact on Product Attributes. CRC Press, 2017

15AG025	PRODUCTION TECHNOLOGY OF HORTICULTURAL CROPS	3 0 0 3

Course Objectives

- To acquire the knowledge on the nursery and propagation techniques.
- To learn the management of crops including soil / irrigation / fertilizers/ pest and diseases management.
- To impart knowledge on horticultural crops such as fruits, vegetables, flowers and plantation crops and their cultivation techniques to increase the production.
- To learn about harvesting, handling, value addition and storage of horticultural products
- To impart knowledge on machineries in horticulture production

Course outcomes (Cos)

1. Possess the knowledge on the cultivation practices for raising different horticultural crops such as fruits, vegetables, cut flowers, potted plants, bedding plants, and bulbs and floral design.
2. Acquire knowledge on various irrigation / fertilizer application and weed management practices
3. Possess the knowledge on Dry land, garden land horticulture and precision farming.
4. Possess knowledge on harvesting, handling, value addition and storage of horticultural products.
5. Acquire knowledge on different machineries to be utilized in horticulture

UNIT I **9 Hours**

FUNDAMENTALS OF HORTICULTURE

Horticulture - Definition - scope and importance - Division and classification of horticultural crops – Fruits, Vegetables, Flowers, Plantation crops, medicinal crops and their significance – Nutritive value of horticultural crops

UNIT II **9 Hours**

PROPAGATION AND CROP MANAGEMENT TECHNIQUES

Nursery techniques - propagation of Propagation - definition - propagation methods - seed propagation-vegetative propagation - Weed management - irrigation and moisture conservation - Nutrition of horticultural crops and application methods in horticultural crops

UNIT III **9 Hours**

PRODUCTION TECHNOLOGY OF FRUITS AND VEGETABLES

Production techniques of mango, banana, grapes, citrus, pomegranate, guava - Production techniques of brinjal, bhendi, tomato, chillies, cole vegetables, cucurbits viz., pumpkin, bitter gourd, snake gourd, ribbed gourd and greens

UNIT IV **9 Hours**

PRODUCTION OF FLOWRS, PLANTATION AND MEDICINAL CROPS

Cultivation practices of folwer crops viz., rose, jasmine, Tuberose, chrysanthemum - cultivation practices of plantation crops viz., coconut, arecanut, tea, coffee – cultivation of medicinal plants viz., Coleus, Ocimum, mint

UNIT V **9 Hours**

POST HARVEST TECHNOLOGY AND MACHINERIES

Tools and machineries utilized for cultivation, protection and harvesting of horticultural crops - Post harvest techniques - processing and value addition - storage - package - marketing and export potential of horticulture produce

FOR FURTHER READING

Production of organic horticulture products by avoiding chemical fertilizers and pesticides -Case studies on commercial horticultural ventures and precision farming

Total: 45 Hours

References

1. Thamburaj, S., M.Kannan and V.Kanthaswamy.1997. Horticultural crop varities released from TNAU.KRS offset printers Coimbatore.
2. Veeraragavathatham, D 1998. A Guide on vegetable culture. Suri Associates, Coimbatore.
3. George Acquaah. 2002. Horticulture-principles and practices, Prentice-Half of India Pvt. Ltd., New Delhi.
4. Veeraragavathatham, M 2004 Scientific fruit culture. Suri Associate, Coimbatore.
5. Sarangi, A.B and S.Datta 2015. Value addition of horticultural crops. Springer, Delhi.
6. Gupta, S.N. 2016. Instant horticulture, Jain brothers, New Delhi.

e References:

1. http://aggie-horticulture.tamu.edu/propagation/propagation.html
   http://www.britannica.com/
2. http://www.horticulture.com.au/export/hmac.asp
3. http://www.horticultureworld.net/hort-india.htm
4. http://www.fao.org

15AG026 MUSHROOM PRODUCTION TECHNOLOGY 3 0 0 3

Course Objectives

- To provide hands on training for preparing the mother culture (Spawn production).
- To study the various methods of mushroom cultivation.
- To provide the training for using appropriate technology, utilization of resources and suitable market strategy for mushroom production.

Course Outcomes (COs)

1. Possess knowledge on mushroom can convert waste material into human food.
2. Possess knowledge on mushroom cultivation can be concentrated within a relatively small space.
3. Understand the marketing linkages with centre to increase employment opportunities and generating income

UNIT I
INTRODUCTION OF MUSHROOM **8 Hours**

History of mushroom - Scope and Importance - Life cycle of mushroom - Area, Production, Productivity of mushroom in World, India and Tamil Nadu

UNIT II
MOTHER SPAWN PRODUCTION **9 Hours**

Mushroom growing technologies - Preparation of mother spawn - Substrates used for spawn production - Growing conditions for mushrooms - Composting unit - Spawn unit- Cropping unit of mushroom

UNIT III
MUSHROOM CULTIVATION **12 Hours**

Types of mushroom - Oyster mushroom - Paddy straw mushroom - Button mushroom - Milky mushroom - Shiitake mushroom - Other mushrooms

UNIT IV
PEST MANGEMENT AND POST HARVEST METHODS **9 Hours**

Pest and diseases of mushroom - Harvesting, storing and using mushrooms - Post-harvest technology and value addition of mushroom

UNIT V
ECONOMICS OF MUSHROOM PRODUCTION **7 Hours**

Economics for mushroom cultivation -Environmental, Economic and Social impacts on mushroom cultivation - Visit to Commercial mushroom cultivation Unit

FOR FURTHER READING

Government policies and programmes for promotion of mushroom

Total: 45 Hours

References

1. V.N. Pathak, N. Yadav and M. Gaur. 2010. Mushroom production and processing technology. Published by Agrobios, Jodhpur.
2. B.C. Suman and V.P. Sharma. 2007. Mushroom cultivation in India. Daya Publishing House, New Delhi. 179p.
3. S.R. Mishra. Techniques of mushroom cultivation. Discovery Publishing, New Delhi. 180p.

4. Tradd Cotter. 2014. Organic mushroom farming and mycoremediation: Simple to advanced and experimental techniques for indoor and outdoor cultivation. Chelsea Green Publishing, White River Junction, USA. 400p.

Website

www.aginfra.eu
http://mushroomsociety.in/?page_id=1100

15AG027 AGRI BUSINESS MANAGEMENT AND ENTREPRENEURSHIP 3 0 0 3

Course Objectives

- To develop the management competencies required by student in the field of Agriculture to establish and support profitable agribusiness in a competitive global business environment
- The ability to use effectively business management techniques in an international environment

Course Outcomes (COs)

1. Possess knowledge on understanding the international Agribusiness and its importance
2. Possess knowledge on the structure and technologies of the agribusiness sector
3. They should be able to analyses agribusiness situations, formulate strategies, implement plans and manage strategic change

UNIT I

AGRIBUSINESS MANAGEMENT **9 Hours**

Concept - components of agribusiness - forms of agribusiness firms. Management - concept - functions of management - managerial roles and skill (Mintzbergs) required at various levels of management.

UNIT II

MANAGEMENT FUNCTIONS **9 Hours**

Planning - steps and types of plans. Organizing - basis for Departmentation - Staffing - human resource planning process - Directing - techniques of direction. Coordination and control - types.

UNIT III

FUNCTIONAL AREA - I **9 Hours**

Operations management - planning and scheduling - supply chain management in agribusiness - Human resource management - job analysis, recruitment and selection process

UNIT IV

FUNCTIONAL AREA - II **9 Hours**

Marketing Management - market segmentation, consumer buying behaviour and marketing mix - Financial management - concept and financial planning for agribusinesses

UNIT V

ENTREPRENEURSHIP **9 Hours**

Entrepreneur - entrepreneurship - types, characteristics and process - Innovation, business incubation and financing entrepreneurs.

FOR FURTHER READING

Market survey for understanding client needs and satisfaction - Pricing methods for small agribusinesses

Total: 45 Hours

References

1. Koontz.H and Weihrich.H, 2013, 'Principles of Management', Tata McGraw Hill, New Delhi.
2. Howard H Fredrick and Donald F Kuratko, 2010, 'Entrepreneurship – Theory, Process, Practice', Cengage Learning Publishers, Melbourne
3. Prasad, L.M, 2005, 'Principles and Practices of Management', Sultan Chand and Sons Educational Publishers, New Delhi.
4. Veerabhadrappa Havinan , 2009 'Management and Entrepreneurship', New Age International Publishers, New Delhi

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15AG028 AGRICULTURAL FINANCE, BANKING AND CO-OPERATION 3 0 0 3

Course Objectives

- To study the various methods of mushroom cultivation
- To reconstruct the policies and of co-operative so that it can bring about economic development of people

Course Outcomes (COs)

1. To create a confidence in the preparation and use of business accounts
2. The opportunity to prepare, as part of their final management project, a thorough analysis of a business situation
3. Understand the marketing linkages with centre to increase employment opportunities and generating income

UNIT I

AGRICULTURAL FINANCE - NATURE AND SCOPE **9 Hours**

Agricultural Finance: Definition, Importance, Nature and Scope - Agricultural credit: Meaning, Definition, Need and Classification - Sources of credit - Role of institutional and non - institutional agencies - Rural indebtedness: Consequences of rural indebtedness Development of rural credit in India

UNIT II

FARM FINANCIAL ANALYSIS **9 Hours**

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 Hours**

Institutional Lending Agencies - Commercial banks: Nationalization, Agricultural Development Branches - 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 - Subsidized farm credit, Differential Interest Rate (DIR), Kisan Credit Card (KCC) Scheme - Relief Measures and Loan Waiver Scheme and Know Your Customer (KYC)

UNIT IV

CO-OPERATION **9 Hours**

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 - 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 Hours**

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 - Livestock Insurance Schemes - Agricultural Insurance Company of India Ltd (AIC)

FURTHER READING

Role of technology in finance and banking sector in India

Total: 45 Hours

References

1. Subba Reddy, S. and P. Raghu Ram. 2011. Agricultural Finance and Management. Oxford & IBH. New Delhi.
2. Muniraj, R. 1987. Farm Finance for Development. 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. Patnaik, V.E. and A.K. Roy. 1988. Cooperation and Cooperative Management. Kalyani Publishers, Ludhiana.

OPEN ELECTIVES

15AG0YA ENTREPRENEURSHIP DEVELOPMENT AND FOOD QUALITY MANAGEMENT IN FOOD INDUSTRY **3 0 0 3**

Course Objectives

- To introduce the concept of food hygiene, and importance of safe food storage
- To study important food laws and basic food qualities assessment tests
- To acquire knowledge on entrepreneurship development through case studies and project preparations

Course Outcomes (COs)

1. Possess the skills of project preparation for food industries
2. Know important food laws and their implications
3. Gain the knowledge on important food quality aspects and safe food storage

UNIT I **9 Hours**

FOOD SAFETY AND HYGIENE

Factors affecting food safety - Food spoilage - Food handling - Special requirements for high-risk foods - Safe food cooking temperature and storage techniques. Hygiene and Sanitation in Food Service Institutions - Cleaning and disinfection. Personal hygiene- Pest control -Waste disposal. Sensory Methods of Food Quality Testing - Sensation of taste, smell, appearance and flavor, sensory evaluation techniques.

UNIT II **8 Hours**

FOOD QUALITY MANAGEMENT

Characteristics of quality - Quality Control -Quality Assurance- Total Quality Management - Quality Management System- Good Manufacturing Practices - Hazard Analysis Critical Control Point System (HACCP).

UNIT III **8 Hours**

FOOD LAWS AND REGULATIONS

Introduction to food acts, laws and standards - National food safety and standard act - International standards, regulatory agencies- Consumer protection act.

UNIT IV **10 Hours**

ENTREPRENEURSHIP DEVELOPMENT

Case studies of successful entrepreneurs -Exercises on ways of sensing opportunities -sources of idea, creating efforts, SWOT Analysis. Entrepreneurial skill assessment test - Techniques of development of entrepreneurial skills, positive self image and locus of control.

UNIT V **10 Hours**

FOOD BUSINESS MANAGEMENT

Case studies of Food Processing Business and its aspects-Business opportunity Identification and Assessment techniques - Business Idea Generation and evaluation exercise - Market Assessment study Analysis of competitive situation - SWOT Analysis for business and for competitors - Preparation of business plan - Preparation of project report - Methods of Arrangement of inputs, finance and material.

FOR FURTHER READING

Case studies on Break-even analysis of agro based industries

Total: 45 Hours

References

1. S S Acharya and N L Agarwal, Agricultural Marketing in India, Oxford & ISH Publishing Co, New Delhi, 1987.
2. Chandra Prasanna, Projects, Planning, Analysis, Selection, Implementation and Review, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1996.
3. D. David and S Erickson, Principles of Agri Business Management, McGraw Hill Book Co, New Delhi, 1987.
4. David H. Holt, Entrepreneurship, A new Venture Creation, Prentice Hall of India, New Delhi, 2002.
5. Phillip Kottler, Marketing Management, Prentice Hall of India Private Limited, New Delhi, 1994.
6. Vasant Desai, The Dynamics of Entrepreneurial Development and Management, Himalya Publishing House Pvt. Ltd, Mumbai, 2011.

15AG0YB HUMAN ENGINEERING AND SAFETY IN AGRICULTURE 3 0 0 3

Course Objectives

- To understand the Importance of ergonomics and its application in agriculture
- To learn the ergonomic aspects in the design of farm machinery and tractors for safety of human beings
- To study the test procedures and safety standards at work place during various farm operations

Course Outcomes (COs)

1. Possess the knowledge on the importance of ergonomics and its application in agriculture
2. Know the test procedures to take anthropometric data and measurement techniques
3. Apply the safety standards at work place during various farm operations

UNIT I **5 Hours**

INTRODUCTION

Concept and design criteria for optimum mutual adjustment of man and his work: Importance of ergonomics and its application in agriculture, liberation and transfer of energy in human body, concept of indirect calorimeter, work physiology in various agricultural tasks.

UNIT II **9 Hours**

HUMAN STRESS AND MEASUREMENT

Physiological stress indices and their methods of measurement: Mechanical efficiency of work, fatigue and shift work.

UNIT III **9 Hours**

ANTHROPOMETRY AND BIOMECHANICS

Anthropometric data and measurement techniques, joint movement and method of measurement, analysis and application of anthropometric data, measurement of physical and mental capacities.

UNIT IV **10 Hours**

HUMAN LIMITATIONS TO STRESS AND SAFETY STANDARDS

Human limitations in relation to stresses and demands of working environments. Mechanical environment; noise and vibration and their physiological effects, thermal environment; heat stress, thermal comfort, effect on performance and behavior, field of vision, color discrimination, general guidelines for designing visual display, safety standards at work place during various farm operations and natural hazards on the farm. Farm safety legislation.

UNIT V **12 Hours**

MAN-MACHINE SYSTEM CONCEPT

Human factors in adjustment of man and his work. Design aspects of foot and hand controls on tractors and farm equipment. Design of operator's seat for tractors and agricultural equipment. Measurement of physical and mental capacities and limitations of human-being in relation to the stress and environment, anthropometric measurements, study of human response to dust, noise and vibrations. Case studies on ergonomics. Problems of posture and comfort; science of seating cushion functional requirements, static and dynamic compatibility of operator-seat-machine; Engineering principles applied to industrial and agricultural safety. Road accidents, road signs and accident prevention; Safety symbols and signs, hand signals, colour codes for agricultural equipment.

FOR FURTHER READING

Analysis of case studies on ergonomic study of different farm implements and machinery

Total: 45 Hours

References

1. R.S. Bridger, Introduction to Ergonomics, McGraw Hill, 1995.
2. Charles D Reese, Accident / Incident Prevention Techniques, Taylor & Francis, 2001.
3. Gavriel Salvendy, Hand Book of Human Factors and Ergonomics, John Wiley & Sons, 1997.
4. J Mathews & AA Knight, Ergonomics in Agricultural Design, National Institute of Agric. Engineering, Wrest Park, Silsoe, Bedford, 1971.
5. Mathews J Sanders, Cormicks MS & MCEj, Human Factors in Engineering and Design, 4th Ed, McGraw Hill, 1976.
6. Lea and Febiger Zander J, Principles of Ergonomics, Elsevier, 1972.

15AG0YC ENERGY MANAGEMENT IN AGRICULTURE 3 0 0 3

Course Objectives

- To study the sources of energy, conservation of energy and its management
- To study the energy use scenario in agricultural production system and agro-based industries
- To learn about energy efficiency, energy planning, forecasting and energy economics

Course Outcomes (COs)

1. Possess the knowledge on the methods of energy audit needed for agricultural farms
2. Conduct energy audit in farms and suggest suitable energy conservation measures

UNIT I **10 Hours**

ENERGY RESOURCES IN THE FARM

Conventional and non-conventional forms of energy and their use- Heat equivalents and energy coefficients for different agricultural inputs and products- Pattern of energy consumption and their constraints in production of agriculture- Direct and indirect energy-Commercial and non-commercial energy-renewable and non-renewable energy sources in the farm.

UNIT II **8 Hours**

ENERGY AUDIT IN PRODUCTION AGRICULTURE

Energy audit -types-steps in energy audit - energy audit in production agriculture- energy audit in rural living and scope of energy conservation.

UNIT III **9 Hourz**

ENERGY ANALYSIS TECHNIQUES AND METHODS

Identification of energy efficient machinery systems, energy losses and their management. Energy analysis techniques and methods- energy balance, output and input ratio, resource utilization, conservation of energy sources.

UNIT IV **10 Hours**

ENERGY CONSERVATION PLANNING AND PRACTICES

Energy forecasting- energy economics- energy pricing and incentives for energy conservation-factors affecting energy economics. Energy modeling for the farms.

UNIT V **8 Hours**

CASE STUDIES

Case studies conducted on energy audit in agricultural farms and comparative study.

FOR FURTHER READING

Reports on the Assessment of Energy requirements of different operations in the cultivation of various crops

Total: 45 Hours

References

1. Kennedy WJ Jr. & Wayne C Turner, Energy Management, Prentice Hall, 1984.
2. Pimental D, Handbook of Energy Utilization in Agriculture, CRC Press, Boca Raton, FL, 1980.
3. CRC Fluck & Baird CD, Agricultural Energetics, AVI Publs, 1984.
4. JW Twindal & Anthony D Wier, Renwable Energy Sources, E & F.N. Spon Ltd, 1986.
5. SR Verma, JP Mittal and Surendra Singh, Energy Management and Conservation in Agricultural Production and Food Processing, USG Publn, Dist, Ludhiana, 1994.
6. G.D. Rai, Non-conventional Sources of Energy, Khanna Publs, 1998

15AG0YD FARM MECHANISATION 3 0 0 3

Course Objectives

- To understand the concepts of agricultural mechanization in India
- To know the mechanization requirements of each operation in agricultural production
- To know and differentiate between the different types of machinery and labour saving devices used in agricultural production

Course Outcomes (COs)

1. Understand the necessity of agricultural mechanization importance in agriculture
2. Learn the advantages of adopting appropriate mechanisation inputs in agriculture as well as constraints to their adoptions
3. Possesses the knowledge on different types of machinery and labour saving devices over the conventional devices and methods used in agricultural production

UNIT I **10 Hours**

THE SCOPE OF MECHANIZATION INDIAN AGRICULTURE

Introduction to the concept of mechanization - definition and its impact in the agricultural development of the country and the role of agriculture in the economic progress of the country. Precision farming-its significance-history of farm mechanization in India. Different Sources of Power in agriculture -tractors, power tillers-bulldozers etc. -History of Development of farm tractors in India.

UNIT II **6 Hours**

TILLAGE AND PROBLEMS IN FARM MECHANISATION

Major problems in adopting and adapting farm mechanisation inputs suitable to their specific needs-possible solutions to overcome them. Tillage-definition -objectives-types- their functions and applications.

UNIT III **10 Hours**

IMPLEMENTS USED IN FARMING OPERATIONS

Types of implements based on usage-primary and secondary-trailed and mounted- functions-applications- animal drawn ploughs. Planting machinery-Intercultural operations-weeders-types and their functions.

UNIT IV **10 Hours**

HARVESTING EQUIPMENT AND PLANT PROTECTION MACHINERY

Different kinds of crop harvesting machinery-features-functions and applications. Basics of knapsack sprayers, foot pedal operated sprayers, power sprayers, boom sprayers and dusters.

UNIT V **9 Hours**

ERGONOMICS AND AUTOMATION

Ergonomic aspects of farm implements-automation of agricultural machinery-latest developments in automation- application of electronics in agriculture.

FOR FURTHER READING

Reports on Automation of various agricultural operations from International journals like Electronics in Agriculture by Elsevier Publications

Total: 45 Hours

References

1. J.M. Shippen, C.R.Ellin and C.H. Clover, Basic farm machinery, Pergamon Press Ltd, 1987.
2. C.J. Studman, Agricultural and horticultural engineering, Butterworths PVT Ltd, 1990.
3. R.N. Kaul, and C.O. Egbo, Introduction to Agricultural Mechanisation, Macmillan, London, 1985.
4. S. Nath, Manual of Practicals in Farm Mechanisation, Unitech Printery, 1988.
5. C.P. Crossley, and J. Kilgour, Small Farm Mechanisation for Developing Countries, Wiley, London, 1983.
6. FAO - Elements of Agricultural Machinery (Vol 1 - 11). Agricultural Service Bulletin No.12, 1977.

ONE CREDIT COURSES

15AG0XA OPERATION AND MAINTENANCE OF MICRO IRRIGATION SYSTEM - - - 1

Course Objective:

- To understand the components of micro irrigation
- To assess the location of malfunctioning in micro irrigation
- To rectify the issues to ensure proper functioning of the system

Course Outcome (s):

1. Will be familiarized with different components of micro irrigation system
2. Can easily identify the problem and rectify it

UNIT I **4 Hours**

INTRODUCTION TO MICRO IRRIGATION SYSTEM

Drip Irrigation – Types and Advantages – Components – Sprinkler Irrigation System – Components – Automation in Micro Irrigation System – Components in Automation – Relay and Switches for Automation.

UNIT II **4 Hours**

MAINTENANCE OF DRIP IRRIGATION SYSTEM

Daily Maintenance – Fortnightly Maintenance – Monthly Maintenance – Half Yearly Maintenance – General Maintenance Tips – Precautions for Inline System

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UNIT III **4 Hours**

CHEMICAL TREATMENTS IN DRIP IRRIGATION SYSTEM

Acid Treatment – Types of Acids – Procedure for Acid Treatment – Troubleshooting – Chlorine Treatment – Sources of Chlorine – Procedure for Chlorine Treatment – Safety Precautions during Chlorine Treatment.

UNIT IV **4 Hours**

TROUBLE SHOOTING AND REMEDIES

Leakages in Submain, Inline, Lateral Joints – Non Uniformity in Drippers – Drop in Pressure – Opening and Closure of Solenoid Valves – Connectivity in Electrical Communication for Automation.

Total: 16 Hours

15AG0XB CUSTOM HIRING CENTRE - - - 1

Course objectives

- To understand the importance of farm mechanization and labour shortage in agricultural operation.
- To learn the operationalization and establishment of CHCs
- To study the cost of operation of the farm implements and equipments.

Course outcomes (COs)

1. Possess the knowledge on the importance of CHCs in the field of agricultural engineering.
2. Know the cost of operation per unit area.
3. Explain why custom hiring centre is important for farm mechanization.

UNIT I **4 Hours**

INTRODUCTION

Introduction to farm mechanization- establishment of CHC- operationalization- machinery selection- area wise-crop wise- storage of implements.

UNIT II **4 Hours**

COST OF OPERATION

Methods of cost of operation-cost fixing-hour basis-area basis- depreciation methods- straight line, declining balance, sum –of- the- years'- digit- fixed cost- variable cost- breakeven point.

UNIT III **4 Hours**

TILLAGE AND SOWING EQUIPMENTS

Tillage-primary tillage-sub-soiler, chisel, MB plough, disc plough-secondary tillage-rotavator, cultivator, disc harrow- laser leveler- sowing equipments- broadcaster- sedd drill, seed sum fertilizer drill- planter-paddy transplanter- vegetable transplanter-nursery raising methods- cost of operation calculation.

UNIT IV **4 Hours**

INTERCULTURAL IMPLEMENTS

Weeder-wet land , dry land -cono weeder, power weeder- sprayer-manual, power -duster-manual,power- fertilizer applicator-manure spreader- cost of operation calculation.

UNIT V **4 Hours**

HARVESTING MACHINERY

Harvester- paddy, sugarcane, ground nut- digger- potato, carrot, onion- thresher- maize, paddy- cost of operation calculation.

Total: 20 Hours

15AG0XC AGRO PROCESSING CENTER (APC)

Course Objective

- Learn the concept and the components involved Agro-Processing Centre (APC).
- Impart knowledge on application of Agro-Processing Centre (APC).

Course Outcomes (COs)

1. Understand different components of a Agro-Processing Centre and the various process involved in it.
2. Understand the processing of various food products and value addition
3. Apply knowledge of Agro-Processing Centre (APC) for entrepreneurship.

UNIT I **3 Hours**

ESTABLISHMENT OF AGRO PROCESSING CENTRE

Introduction – Agro processing centre – factors involved in Agro-Processing Centre – Survey- design - plant layout - Crop wise production -Population of villages- Machines identified for agro-processing centre- Location of the site of Agro Processing Centre- Existing farm level processing facilities in village - Processing facilities available in village- Details of equipments/machines in Agro Processing Centre- Economic analysis of Agro Processing Centre

UNIT II **6 Hours**

PROCESSING AND VALUE-ADDITION TECHNOLOGY FOR CEREALS, PULSES AND OILSEEDS

Introduction – cereals – rice – processing - equipments- by products and importance- value addition processed products- fermented products- extruded products- instant mixes- preparation of supplementary food mix – wheat, oats , barley pulses and oil seeds – processing - equipments- by products and importance- value addition.

UNIT III **6 Hours**

PROCESSING AND VALUE-ADDITION TECHNOLOGY FOR RATOON CROPS, FRUITS AND VEGETABLES

Introduction- ratoon crops – sugarcane, forage crops - fruits– amla, mango,papaya, guava, pianapple, tamarind and other fruits- processing - equipments- by products and importance- value addition- vegetables– onion, tomato, green leafy, roots, tubers and other vegetables- processing - equipments- by products and importance- value addition.

UNIT IV **5 Hours**

PROCESSING AND VALUE-ADDITION TECHNOLOGY FOR SPICES, PLANTATION CROPS AND MEDICINAL PLANTS

Introduction- spices- Turmeric, chilly, ginger, pepper, cardamom and other spices – processing - equipments- value addition- plantation crop- coconut, tea, coffee, nuts and cocoa– processing - equipments-- by products and importance- value addition- medicinal plants- amla, bael and stevia– processing - equipments-- by products and importance- value addition

UNIT V **3 Hours**

PROCESSING AND VALUE-ADDITION TECHNOLOGY FOR ANIMAL AND SEA FOODS

Introduction- animal foods- milk, egg , chicken and meat – processing - equipments- by products and importance-value addition- sea foods – fish, crab and prawn – processing - equipments-by products and importance- value addition.

Total: 20 Hours

References

1. Mangaraj Shukadev, Agro Processing and Value Addition for Entrepreneurship DevelopmentSatish, Serial Publishing House, 2014
2. Bakker-Arkema, CIGR Handbook of Agricultural Engineering, Volume IV Agro-Processing Engineering , Published by the American Society of Agricultural Engineers, USA.

15AG0XD LANDSCAPE DESIGNING AND ARCHITECTURE

- - - 1

Course Objectives

- To provide broad overview on various landscaping software
- To create perspective visualization on landscaping concepts
- To impart hands on training and skill in developing garden designs through software

Course Outcomes (COs)

1. Understand broad overview on various landscaping software.
2. Understand perspective visualization on landscaping concepts
3. Apply knowledge of landscaping designs through software

UNIT I **4 Hours**

Introduction to landscape horticulture - Overview of software for Computer Aided Design and Drafting (CADD) – related landscape graphic oriented software (Real time landscape, 3D Max, Archi-CAD, etc.) – Graphic communication

UNIT II **4 Hours**

Perspective sketching – Plan drawing section – object portions – view points – Elevation - Design forum – Master planning – residential and corporate landscape designs – Landscape projects – Architecture projects

UNIT III **4 Hours**

AUTOCAD plants and Design Coordinate system – Drawing tools – Modifying tools – Drawing properties – Dimensioning – Layer, Block, Group and attribute setting – Autocad design centre – Shortcut keys

UNIT IV **4 Hours**

AUTOCAD - File handling Importing / exporting / Printing drawings – Drawing output – Tender drawings, Advance copy, Good for execution (GFE) and revisions – File conversions.

UNIT V **4 Hours**

Photoshop and Sketch up Basic drawing concepts of photoshop and its applications in CAD landscape designs – Google sketch up to three-dimensional rendering – 2 D drawing to presentation drawing – Free sketch up download.

Total: 20 Hours

References

Christine Wein - Ping Yu. 1987. Computer aided design: Application to conceptual thinking in landscape architecture

e - Resources

http://www.cadforum.cz
http://cben.net
http://www.freedwg.en
http://www.bibilocad.com
http://www.the-landscape-design-site.com
http://landscaping.about.com

15AG0XE TRAINING ON THE MANUFACTURE OF AGRICULTURAL IMPLEMENTS

- - - 1

15AG0XF TRAINING ON MAINTENANCE ASPECTS OF TRACTOR/COMBINE HARVESTER/POWER TILLER

- - - 1

ADDITIONAL ONE CREDIT COURSES 15GE0XA HEALTH AND FITNESS

Course Objectives

- To understand the fundamental concepts about physical fitness & its types, training and assessment of physical fitness.

Course Outcomes (COs)

1. Acquire the knowledge and training of the individual physical, mental and social concepts.
2. Understand the fundamental concepts of yogic practice and physical fitness.
3. To acquire the knowledge about nutrition and health consciousness.

Fitness: Meaning & Definition – Need & importance of Physical fitness – Types Physical fitness - Exercise, Training and Conditioning and it is important.
Yoga: Meaning and definition – Principles of practicing – Basic Asana and it important – Pranayama and Meditation - Relaxation Techniques.
Nutrition and Balance Diet: Needs and Important – Significant of Nutritional Food - Tips for balance diet. **Common Diseases for IT professionals:** Common diseases - cause – prevention – First aid for common sports injuries.

Total: 15 hours

References

1. Anderson, Bob., Pearl, Bill.,&Burke, Edmund R., (2001). *Getting in Shape Workout Programs for Men&Women*. Mumbai: Jaico Publishing House.
2. Baechle, Thomas. R, & Earle, Roger. W., (2000). *Essentials of Strength Training and Conditioning*. Champaign: Human Kinetics.
3. Iyengar, BKS., (2003). *The Art of Yoga*. New Delhi: Harper Collins Publishers.
4. Singh, Hardayal, (1995). *Science of Sports training*. New Delhi: D.V.S. Publications.
5. Begum, Raheena. M., (2002). A Textbook of Foods, Nutrition and Dietetics. New Delhi: Sterling Publishers Private Limited.

15GE0XB FOUNDATION COURSE IN COMMUNITY RADIO TECHNOLOGY

Course Objective

- The course focuses on community radio technology and various program productions techniques for radio broadcasting.

Course Outcomes (COs)

1. Understand the hardware required for field recording and setting up a studio and carry out studio and field recording
2. Examine the available options for telephony interfaces for radio
3. Demonstrate proper techniques of wiring, fixing of connectors, soldering and use of tools and equipment for studio work.

INTRODUCTION TO COMMUNITY RADIO

Evolution of Community Radio (CR) in India- principles behind setting up of CR- policy guidelines and their impact on technology and content of a CR station- fundamental principles behind deciding the technology for a CR station.

STUDIO TECHNOLOGY

Properties and components of sound-difference between analogue and digital audio-hardware required for field recording and setting up a studio-fundamental principles for setting up an audio studio

AUDIO PRODUCTION

Concept of recording and storing audio-hardware related to audio recording-open source software solutions for audio production- telephony interfaces for radio- audio Post Production

STUDIO OPERATIONS

Wiring, fixing of connectors, soldering and use of tools and equipment- preventive and corrective maintenance of studio and equipment.

RADIO TRANSMISSION TECHNOLOGY

Components of the FM transmission chain- FM transmitter-different types of FM antenna - coaxial cable- propagation and coverage of RF signals-FM transmitter setup

Total: 15 Hours

Reference(s)

1. UNESCO (2001). Community Radio Handbook.
2. Vinod Pavarala, Kanchan K Malik, "Other Voices: The Struggle for Community Radio in India", SAGE Publications India,2007.
3. Steve Buckley, Mark Raboy, Toby Mendel, Kreszentia Duer, Monroe E. Price, Seán Ó Siochrú, "Broadcasting, Voice, and Accountability: A Public Interest Approach to Policy, Law, and Regulation", University of Michigan Press, 2008.
4. www.floridasound.com
5. www.mediacollege.com
6. www.procosound.com

15GE0XC VEDIC MATHEMATICS

Course Objectives

- To improve their calculation speed, analytical thinking and numerical skills.

Course outcome (CO)

1. Solve problems creatively in mathematics and its applications.

Vedic Mathematics

Addition- Subtraction- System of Multiplication- Squaring numbers- Cube roots- Square roots- Solution of simultaneous equations- Solutions of Quadratic equations-

Total: 15 Hours

References

1. Dhaval Bathia, Vedic Mathematics, JAICO Publishing House, 29th Edition, Mumbai, 2014.
2. Jagadguru Swami Sri Bharathi Krsna Tirthaji Maharaja, Vedic Mathematics, Motilal Banarsidass Publishers Private Limited, New Delhi, 1997.

15GE0XD INTRODUCTION TO ALGORITHM

Course Objectives

- Analyze the asymptotic performance of algorithms, Divide and conquer and Dynamic Problems.
- Use Sorting and Searching algorithms for arranging the data.
- Apply important algorithmic techniques to solve the real world Problems.

Course Outcomes (COs)

1. Apply Divide and conquer and Dynamic Programming Algorithm techniques to Provide the solutions for simple Problems.
2. Design algorithms for Performing Sorting and Searching of data.
3. Construct the Graph, Heap and BST for the given Data information.
4. Algorithm Design Techniques: Divide and Conquer, Dynamic Programming, Sorting and Searching, Basic graph algorithms –Simple Data Structures: Heaps, Balanced Search Trees.

Total: 15 Hours

References

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2015.
2. Thomas H. Cormen. Charles E. Leiserson. Ronald L. Rivest. Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press, 2014.
3. J.P.Tremblay and P.G.Sorenson, An Introduction to Data Structures with Application II Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2008.

15GE0XE ETYMOLOGY

- - - 1

Course Objectives

- To increase vocabulary and enhance use, knowledge, and understanding of the English language;
- To stimulate an appreciation for the English language, including how it developed, how new wordsenter the language, and how it continues to be dynamic;
- To demonstrate the importance of a broad-based vocabulary for effective oral and written communication

Course Outcomes (COs)

1. Examine prefixes, roots, and suffixes of Latin, Greek, Germanic, and Anglo-Saxon origin.
2. Explore the historical aspects of language, including the infusion of Indo-European languages, semantic changes, and the influence of world events.

CONVENTIONS &VOCABULARY

Acronyms – Abbreviations – Initialisms – Jargon – Neologisms - Idiomatic Expressions – Euphemisms – Spoonerisms – Malapropisms – Mondegreens - Words Derived from Latin - Words Derived from Greek - Words Derived from - Germanic/Anglo-Saxon - Abstract word Acronym - Affix Analogy - Antonym – Apheresis - Blend word Assimilation - Colloquial language Clipped word

WORD ANALYSIS

Concrete word Derivative - Dialect Diminutive suffix - Dissimilation Doublet - Etymology Euphemism - Figurative word Homonym - Hybrid word Inflection - Informal language Infusion - Jargon Linguistics - Loan words Metathesis – Modify - Philology Onomatopoeia - Romance language Prefix - Semantics - Root-base word - Suffix Slang - Word component Synonym

Total : 15 hours

Reference(s)

1. Norman, Lewis. Word Power Made Easy,Goyal Publisher. Edition 2.2014.
2. C T Onions. The Oxford Dictionary of English Etymology. Volume 11, Issue 1.70, Wynford Drive, Don Mills, Ont.Oxford University Press.1965.
3. Nurnberg W, Maxwell and Rosenblum, Morris, How to build a better Vocabulary, Completely Revised and Updated, Popular Library.1961

15GE0XF HINDUSTANI MUSIC

Course Objectives

- To have an awareness on aesthetic and therapeutic aspects of Hindustani music
- To identify and differentiate the various styles and nuances of Hindustani music
- To apply the knowledge accumulated throughout the duration of the course by way of improvisation, composition and presentation

Course Outcome (CO)

1. Have Basic knowledge of aesthetic and therapeutic value of Hindustani Music

AESTHETICS

Introduction to music - Aesthetics of Hindustani Music - Classification (Raga, instruments, style as per the presentation and the gharaanaas) - Folk music, Dhamaar, Dhrupad

COMPOSITION AND THERAPEUTIC VALUE

Taal and Raga - Bandeesh, Taraanaa – Madhya and drut laya, Vilambit khyaal as demonstration - Therapeutic benefits of Hindustani music - Stage performance

Total: 20 hours

Reference(s):

1. Devdhar B.R., *Raga bodh (Part 1 & 2)*, Devdhar School of Indian Music, Mumbai, 2012.
2. Vasant, *Sangeet Vishaarad* , Hathras, Uttar Pradesh, 2015.

Websites:

1. *raag-hindustani.com/*
2. *play.raaga.com/Hindustani*
3. *raag-hindustani.com/Scales3.html*
4. *www.poshmaal.com/ragas.html*
5. *www.soundofindia.com/raagas.asp*
6. *https://www.quora.com/Which-is-the-toughest-raga-in-Indian-classical-music*
7. *www.likhati.com/2010/10/20/popular-ragas-for-the-beginner-ear-durga*

15GE0XG CONCEPT, METHODOLOGY AND APPLICATIONS OF VERMICOMPOSTING

Course Objectives

- To understand the importance of safe methods of treating solid wastes generated through various human activities
- To appreciate the skills / devices / practices associated with the compact proceedures of biodegradation of unwanted solid residues

Course Outcomes (COs)

1. Understand the role of recycling of garbage leading to the sustenance of our health and environment.
2. Recognize the organic farming practices and production of healthy food products.
3. Prepare and maintain tips for small scale compost units and thereby becoming more environmentally conscious.

VERMICOMPOSTING TECHNOLOGY **15 Hours**

Ecological roles and economic importance of earthworms - need for earthworm culture – scope and importance of vermiculture – limiting factors - types of worm culturing and the relative benefits – Small scale and commercial methods: process & advantages – Vermicomposting equipments, devices – Design and maintenance of vermi bed - Products from vermiculture (matter & humus cycle) – vermicastings in organic farming/horticulture - Marketing the products of vermiculture – quality control, market research, marketing techniques – Applied vermiculture: use of urban solids & farm/ industrial residues for vermicomposting - Constraints of vermiculture and its future perspectives – Artificial Earthworm as a standalone biodegradation assembly.

Total: 15 Hours

Reference(s)

1. Sultan Ahmed Ismail, 2005. The Earthworm Book, Second Revised Edition. Other India Press, Goa, India.4
2. Vermiculture Technology; Earthworms, Organic Wastes and Environmental Management, 2011, Edited by Clive A Edwards, Norman Q Arancon & Rhonda Sherman, CRC Press
3. www.organicgrowingwithworms.com.au
4. New York Times – Scientists Hope to Cultivate and Immune System for Crops

15GE0XH AGRICULTURE FOR ENGINEERS

Course Objectives

- To impart the basic knowledge of agricultural and horticultural crops, cropping systems
- To study the weed and nutrient management, irrigation water requirement and its quality

Course Outcomes (COs)

1. Understand the science of Agriculture
2. Summarize and apply the methodologies needed in agriculture based on the field conditions.
3. Develop enough confidence to identify the crop patterns in real world and offer appropriate solutions.

AGRONOMICAL PRACTICES AND CROPS **5 Hours**

Definition and scope of agronomy , Classification of Crops, agricultural and horticultural crops Effect of Different Weather Parameters on Crop Growth and Development , Principal of Tillage, Tilth and Its Characteristics, Role of Water in Plant and Its Absorption, Conduction and Transpiration of Water and Plant Processes, Soil Water Extraction Pattern and Plant Response. Introduction to weeds, Weeds Control.

CROP ROTATION, CROPPING SYSTEMS AND MIXED CROPPING **5 Hours**

Crop Rotation, Different Cropping Systems – I, Different Cropping Systems – II, Scope of Horticultural Crops, Soil Requirement for Fruits, Vegetables and Flowers Crops, Climatic Requirement for Fruits, Vegetables and Flowers Crops.

PLANT NUTRIENTS **5 Hours**

Essential Plant Nutrients, Nutrient Deficiency, Toxicity and Control Measures. Chemical fertilizers, fertilizer Reaction in Soil and Use Efficiency

QUALITY OF IRRIGATION WATER AND IRRIGATION METHODS **5 Hours**

Quality of Irrigation Water, Poor Quality of Irrigation Water and Management Practices. Surface Irrigation methods and micro irrigation methods

Total: 20 hours

References

1. SP. Palaniappan, and S. Sivaraman, Cropping systems in the tropics- Principles and Management, New Age international publishers, New Delhi, (2nd edition), 1998.
2. S.Sankaran and V.T Subbaiah Mudaliar, Principles of Agronomy, The Bangalore Printing and Pubg Co, Bangalore, 1993.
3. P.Balasubramain and SP. Palniappan, Principles and Practices of Agronomy, Agrobios publishers, Ludhiana, 2001.
4. T.Yellamanda Reddy and G.H. Sankara Reddi, Principles of Agronomy, Kalyani publishers, Ludhiana, 2005
5. B.Chandrasekaran, B. , K. Annadurai and E. Somasundaram, A Text book of Agronomy, Scientific publishers, Jodhpur, 2007
6. George Acquaah, Horticulture-principles and practices, Prentice-Half of India Pvt. Ltd., New Delhi, 2002.

15GE0XI INTRODUCTION TO DATA ANALYSIS USING SOFTWARE

Course Objectives

- To familiarize students on the features of MS Excel.
- To enable the students to use Excel in the area of critical evaluation.
- Facilitate the student to construct graphs.

Course Outcomes (COs)

1. Create versatile Excel document.
2. Apply built in functions for data analysis.
3. Prepare dynamic Charts.

EXCEL FUNDAMENTALS AND EDITING **4 Hours**

Starting and Navigating a Worksheet– Entering Information – Hyperlinks – Saving – Editing Techniques – Entering a Series of Labels, Numbers and Dates – Checking Errors.

FORMATTING **4 Hours**

Formatting Cells – Changing Column Widths and Row Heights – Creating Conditional Formatting – Using Styles – Creating and Modifying Templates – Changing Page Breaks.

POWER ORGANIZING AND CUSTOMIZING EXCEL **4 Hours**

Managing Worksheets – Referencing Cells in Other Worksheets – Using More than One Work Book – Managing Shared Work Books – Protecting Worksheets and Workbooks.
Adjusting Views – Setting Printing Options – Using Multiple Panes – Customizing Excel Using the Options Dialog Box.

CRUNCHING NUMBERS **5 Hours**

Building a Formula – Using Basic Built-in Functions – Using Functions to Analyze Data – Using Names in Functions – Array Functions

WORK SHEET CHARTS **3 Hours**

Planning a Chart – Creating Chart – Formatting a Chart – Adding Labels and Arrows.

Total: 20 Hours

References

1. Michael J. Young, Michael Halvorson, “Office System 2007 Edition”, Prentice-Hall of India (P) Ltd., New Delhi, 2007
2. John Walkenbach, “Microsoft Office Excel 2007”, Wiley Publishing, Inc. 2007
3. Curtis D. Frye, Microsoft Office Excel 2007 Step by Step, Microsoft Press, 2007
4. Mark Dodgeand Craig Stinson, “Microsoft Office Excel 2007 Inside Out”, Microsoft Press, 2007

15GE0XJ ANALYSIS USING PIVOT TABLE

Course Objectives

- To familiarize students on the features of Pivot Table.
- To enable the students to use Pivot Table in the area of data analysis.
- Facilitate the student to construct the charts for visualization of data.

Course Outcomes (COs)

1. Able to construct the Pivot Table and Group, Sort, Filter the Data to do the analysis.
2. Able to do the Calculation with in Pivot Table for advance analysis.
3. Capable of Constructing Pivot Charts to make visual presentation.

PIVOT TABLE FUNDAMENTALS **4 Hours**

Introduction about Pivot Table, Why and When to use the Pivot Table, Anatomy of the Pivot Table, Limitations, Preparing the Source Data, Creating the Pivot Table.

GROUPING PIVOT TABLE DATA **4 Hours**

Grouping the Items in a Report Filter, Grouping Text Items, Grouping Dates by Month, Grouping Dates Using the Starting Date, Grouping Dates by Fiscal Quarter, Grouping Dates by Week, Grouping Dates by Months and Weeks, Grouping Dates in One Pivot Table Affects Another Pivot Table, Grouping Dates Outside the Range.

SORTING AND FILTERING PIVOT TABLE DATA **4Hours**

Sorting a Pivot Field: Sorting Value Items, Sorting Text Items, Sorting Items in a Custom Order.
Filtering a Pivot Field: Manual Filter, Label Filter, Value Filter, Multiple Filters.

CALCULATIONS WITHIN THE PIVOT TABLES **5 Hours**

Using Formulae: Creating a Calculated Field with and without "IF Condition, Calculated Item, Using Custom Calculations: % of Column, % of Row, % of Total, % Of, Running Total, Difference From,% Difference From, Index.

PIVOT CHARTS **3 Hours**

Creating a Normal Chart from Pivot Table Data, Filtering the Pivot Chart, Changing the Series Order, Changing Pivot Chart Layout Affects Pivot Table, Changing Number Format in Pivot Table Affects Pivot Chart, Converting a Pivot Chart to a Static Chart, Refreshing the Pivot Chart, Creating Multiple Series for Years

Total: 20 Hours

Reference(s)

1. Debra Dalgleish, "Excel 2007 - PivotTables Recipes A Problem-Solution Approach", Apress, 2007, (ISBN-13 (pbk): 978-1-59059-920-4)
2. Bill Felen and Michael Alexander, "Pivot Table Data Crunching for Microsoft Office 2007", Pearson Education, Inc., QUE Series.
3. Wayne L. Winston, "Microsoft Office Excel 2007: Data Analysis and Business Modeling", Microsoft Press, 2007
4. John Walkenbach, "Microsoft Office Excel 2007", Wiley Publishing, Inc. 2007
5. Mark Dodgeand Craig Stinson, "Microsoft Office Excel 2007 Inside Out", Microsoft Press, 2007
6. Curtis D. Frye, Microsoft Office Excel 2007 Step by Step, Microsoft Press, 2007