College of Technology and Engineering

REGULATIONS
AND
COURSE DESCRIPTION

BACHELOR OF TECHNOLOGY

(Agriculture)

Effective from 2017–18

Maharana Pratap University of Agriculture and Technology, Udaipur (Raj.) – 313 001

VISION OF AGRICULTURAL ENGINEERING DEPARTMENT

- To be a centre of excellence which integrates all facets of Agricultural Engineering, entrepreneurship and management and be recognized as the focal point for catalyzing the growth of the agriculture; agricultural engineering and related industry in India in the global context.
- To produce skilful and high quality engineers supported by up-to-date curriculum and scientific and industrial research to suit the industry both within the country and abroad.
- To educate agricultural engineers who can follow and utilize the technological developments that may occur during their careers as well as lifelong learning and recognize the needs of an environmentally sensitive society for scientific and eco-friendly development of the society.
- To support the industry to enhance the techniques by providing databank, testing facilities, suitable consultancy and training services.

MISSION OF AGRICULTURAL ENGINEERING DEPARTMENT

- To impart education and knowledge to students to make them competent enough to contribute towards agricultural and rural development so as to lead the nation at par with the world level scenario.
- To be a prime academic institution in the areas of agricultural engineering, entrepreneurship and management The college offers courses and training programmes of global standards with optimal mix of inputs on agricultural engineering, farm machinery & equipment, process & food engineering, post harvest technologies, irrigation & water management, soil & water conservation engineering, renewable energy & environment engineering; ergonomical aspects, management and entrepreneurship.
- To produce world class business leaders, develop globally competitive processes and technologies and international best practices in the area of agricultural engineering, entrepreneurship and management.
- To carry out R&D in frontier areas, develop world class technologies and assist the Government in policy making in the field of agricultural engineering sector.
- To offer continual training to the industry to enhance their skill and be updated on global trends in agriculture, processing & food & engineering, energy and farm implement research and technology by consultation with the stake holders.
- To keep its educational standards same as with the internationally well-known Agricultural Engineering Departments.
- To educate students to play an active role in industry, satisfying present and future needs of a global society through the development and implementation of revolutionary technologies for the overall development of the society.
- Fully committed to provide need based quality education in all the major areas related with the Farm Machinery and Power Engineering, Processing and Food Engineering, Soil and Water Engineering, Renewable Energy Engineering to the prospective Engineers so that they can not only contribute to the their personal development and prosperity of the society, state and the nation as a whole but also build a leading and successful career in this direction and can work in rural areas for the development of farmers community.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO I: To provide students with a sound foundation in the science, mathematics, engineering and software/ hardware fundamentals for field application. A graduate must be able to view computer systems as an integrated continuum of technologies and to engage in integrated system-level design.

PEO II: A graduate must have the background and necessary perspective to pursue post-graduate/doctoral/post doctoral education. A graduate must be able to work with professionals in related fields over the spectrum of Irrigation Industries, Tractor Companies, Process Industries, Seed and Fertilizer Companies, NGOs and Govt. of Rajasthan as an engineer.

PEO III: To develop the analytical and logical aptitude among students to quickly adapt to new work environments, assimilate new information, and solve new problems.

PEO IV: To provide exposure of new cutting edge technologies to the students and to motivate them to take up new challenges to solve the problems faced by society and nation through research and development.

PEO V: To inculcate the nature of self learning, discipline and leadership qualities with good communication skills in students and to introduce them to holistic approach of working in a team according to the codes of professional practice.

PROGRAMME OUTCOME (POs)

- Graduates will demonstrate an ability to apply knowledge of agricultural engineering, mathematics, probability and statistics as it applies to the field of agricultural engineering for rural development through construction of soil and water conservations strectores, farm mechanization, post-harvest management and value addition of food materials and of horticultural produces etc.
- Graduates will demonstrate in depth knowledge of topics which are critical to surface and underground irrigation practices especially in canal irrigation projects, command area development, on farm development, various works related and affiliated with the Panchayati Raj and MG NREGA, etc.
- Graduates will demonstrate the ability to design a process that meets desired specifications and requirements.
- Graduates will demonstrate the ability to function as a member of engineering and science laboratory teams, as well as on multidisciplinary design teams.
- Graduates will demonstrate the ability to learn and work independently to identify and solve various engineering problems related with Farm Machinery and Power Engineering, Soil and Water Engineering, Irrigation and Water Engineering, Processing and Food Engineering, Post-Harvest Engineering, Renewable Energy Engineering.
- Graduates will demonstrate an understanding of professional and ethical responsibilities.
- Graduates will possess effective communication skills both orally and in writing.
- Graduates will have the confidence and potential to apply engineering solutions in global and social contexts.
- Graduates will be disciplined and will show the capabilities of independent problem solving, self-learning and innovation.
- Graduates will be broadly educated and will have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.
- Graduates will be familiar with modern engineering software tools and equipment to analyse engineering problems.

ACADEMIC REGULATIONS
(UNDER-GRADUATE COURSES)

The students admitted in 2017-18 shall be governed by the relevant rules as indicated below:

1.0 DEFINITIONS

1.1 'Academic Year' or 'Academic Session' of the University shall ordinarily be between July to June and shall consist of two semesters.

1.2 'Semester' is an academic term of normally 18-20 weeks including examinations.

1.3 'Course' means a unit of instruction or a segment of a subject matter to be covered in a semester. Each course is assigned a specific number, title and credits.

1.4 'Credit Hour' also written as 'Credit' means the numerical weight allotted to the course, including its theory and practical parts. One credit will represent one hour of lecture and two to three hours of laboratory/field practical in each week.

1.5 'Grade point' is a numerical number which denotes students performance in a course. It is obtained by dividing the percentage marks obtained by ten.

1.6 'Credit point' is the product of credit and grade point obtained by the student in a course.

1.7 'SGPA' (Semester Grade Point Average) is the average of the credit points of a semester.

1.8 'OGPA' is the overall cumulative grade point average obtained by the student in the courses taken in all the semesters completed by him/her.

1.9 'Year' means an academic session consisting of two semesters. Say, first year means the first academic session of the prescribed course of a degree programme. Similarly, second year, third year and fourth year mean second, third and fourth academic sessions, respectively.

1.10 'Equivalent percentage' is the percentage obtained by multiplying grade point, SGPA and OGPA respectively by ten.

2.0 THE PROGRAMME AND GRADUATION REQUIREMENTS

2.1 Minimum residential requirement and maximum period for all the programmes:

Minimum residential requirement	8 semesters
Maximum period for which a student can remain on the college roll	12 semesters

Note: In case a student does not complete his/her course work satisfactorily (5.0 OGPA out of 10) within the maximum prescribed period he/she shall no longer be a student of the university and the respective Dean of the college shall drop him from the college roll.

3.0 EXAMINATION

There shall be a main theory and/or practical examination conducted by the university at the end of each semester. The theory and practical examinations shall be of three hours duration except otherwise specified. Besides this, there will be a mid-term examination.

3.1 Mid-Term Examination:

A mid-term examination of 20 maximum marks shall be held after completion of about 50% syllabus in each course. The mid-term examination shall be of one hour duration.

"If a student misses the mid-term examination due to any legitimate reason including deputation by the university, then he/she will be permitted to appear in a special mid-term examination before the final examination". Only one special mid-term examination per course shall be conducted for all eligible students under this rule.

Students who are deputed by the university will have to submit the information in advance to the concerned department for awarding attendance.

3.2 The distribution of marks for the mid-term examination, final theory examination and practical examination shall be as follows:

Credit (Marks T/P)	Mid-Term Examination	Final (University) Examination		Total
		Theory	Practical	
1/2/3/4+1	20(T)	50	30	100
0+1/2/3/4	20(P)	-	80	100
1/2/3/4+0	20(T)	80	-	100
1+/2/3/4	20(P)	30	50	100

3.3 The distribution of marks for the final practical examination shall be as under

	Practical with Maximum Marks	**30**	**50**	**80**
(a)	Practical record and day-to-day assessment (Sessional work)	5	10	15
(b)	Practical exercises (may include any exercises as decided by the external examiner)	20	30	50
(c)	Viva-voce	5	10	15

3.4 Grading System

(i) A numerical grading system is followed for evaluation. Each course has a numerical weightage known as credit. The total marks obtained in each course (including its mid-term, theory and practical parts) are converted into percentage and divided by 10 to obtain the grade point for that course. The grade point when multiplied by the total course credit, gives credit points for the course.

(ii) Semester Grade Point Average (SGPA) is simply average of the credit points for a semester. The Overall Grade Point Average (OGPA) is the average for all courses upto the current semester.

If C_i and G_i are the credit and grade points for a course, then OGPA and SGPA are given by the following formulae:

$$\text{SGPA} = \frac{\sum C_i G_i}{\sum C_i} \quad \text{where the summation is for all courses in the semester}$$

$$\text{OGPA} = \frac{\sum C_i G_i}{\sum C_i}$$ where the summation is for all courses of preceding semester including the current one

(iii) The percentage equivalent of OGPA shall be determined by multiplying OGPA by ten.

(iv) The division of the under graduate student shall be determined by the OGPA at the end of successful completion of program as follows:

Division	**OGPA**
First	6.00 and above
Second	5.00 to 5.99

3.5 Pass Requirements:

(i) Candidates are required to pass separately in final theory and/or practical examinations in each course

(ii) For a pass, a candidate is required to obtain at least 40% marks in each theory final examination as well as in each practical final examination and 4.00 grade point in the course.

(iii) The minimum OGPA required for degree is 5.00.

3.6 Promotion to Higher Classes:

(i) The promotion to next class shall be decided only at the end of an academic year.

(ii) A student will be promoted to higher class if he/she secures an OGPA as mentioned in the table below.

Year to which promotion is being Considered	Minimum OGPA required for Promotion
Second	4.00
Third	4.50
Fourth	4.75

(iv) A student who has been promoted to the first Semester of a class as a result of above rule, shall be automatically promoted to the second semester of that class regardless of the result of the year's first semester examination.

(v) If a student is not promoted to a higher class, he/shall become an ex-student of the failed class and has to clear the backlog and/or improve his/her OGPA to be eligible for promotion.

(vi) Provisional Promotion

(a) The Promotion will be provisional with the permission of concerned Dean to higher class till the result of the previous semester is declared.

(b) Student has to register as per academic calendar - i.e., date of registration without late fee and date of registration with late fees would be applicable.

(c) Student has to give an undertaking that on declaration of result, if he/she is not eligible, the registration would stand cancelled automatically.

(d) Student should have a minimum OGPA as per existing UG rules.

(e) Per-requisite courses, if any, have to be cleared prior to the regular courses.

3.7 Clearing of Backlogs and Repeating of Courses for Improvement of OGPA:

A. Clearing of Backlog:

(a) All the students with backlog (whether promoted or ex-students) shall have to appear in the examination of backlog courses in the main examination of the semester in which such courses are regularly offered. The student will be permitted to appear in backlog examination in failed part only whether it is theory or practical or both. He/she shall not be required to attend regular classes for such courses.

(b) Mid-term marks obtained by a student will not be carried over for backlog examination and proportionate marks shall be awarded.

(c) The university shall conduct final examination as per current scheme of examinations. Students offered backlog courses would be required to appear in the equivalent course in the new programme. In case of variation in the course content, student has to do self preparation.

(d) If the backlog course is the result of being detained on account of shortage of attendance, the student has to appear in both theory and practical examinations by regularly offered courses or as a contact course, if time table adjustment is not possible

B. Improvement of OGPA:

(a) Student should apply to improve the OGPA within 11 days from the date of issue of mark sheet of last semester. They should surrender the original mark sheet issued to them and submit the same along with application form.

(b) A student would be given only one chance for improvement of OGPA.

(c) Student will be allowed to repeat two courses of his/her choice irrespective of grade obtained in the course(s) or semester, provided that the course is being offered as regular course in current semester.

(d) There will be a common examination for regular students and for those who have been offered courses for improvement.

(e) Students will not be issued PDC till the result of the courses offered for improvement is declared.

(f) The repeated course shall be marked as "Repeat" in the revised mark-sheet.

(g) In case PDC has been issued to the student he/she will not be eligible for improvement.

(h) The student would be required to pay regular semester fees if he/she wishes to attend the classes. Otherwise he/she shall be treated as Ex-student.

(i) The examination fee for courses offered for improvement will be Rs. 1400.00 (Rupees one thousand and four hundred only) per paper irrespective whether it is a regular course or a special paper.

(j) The student has to submit an undertaking that the marks obtained in the examinations taken for improvement will replace the marks obtained in the original examination of the paper(s), if he/she gets more than previous result.

(k) In case a student fails in the improvement course, he/she will be awarded minimum pass marks in that paper.

(l) Mid-term marks in improvement courses: In such cases, the student will be awarded proportionate marks based on marks obtained in final examination.

3.8 Special Backlog Examination:

A. In case student has completed 8th Semester and has backlog in only one course:

(i) Special examination will be conducted earliest possible after the declaration of semester result i.e. September/October of 1st semester of the academic year for only that course.

(ii) Student will be charged fee as prescribed by the university, irrespective of whether it is a regular course or a special paper.

(iii) Student has to apply for special examination within 11 (eleven) days of declaration of result of 8th semester, failing which his/her application will not be considered.

(iv) If a student fails in a special paper examination, he/she would be allowed to reappear with regular examination of next semester only- i.e., once in a semester.

B. In case a student has completed 8th semester and has got backlog of up to 6 courses irrespective of semester:

(i) Backlog examination will be conducted along with regular examination of the semester.

(ii) If regular examination is being conducted for a particular paper, he/she would have to pay Rs. 750/- per paper for that paper and special fee of Rs. 1400/- per paper will be charged for the course which are not listed for conducting the examinations in that semester.

(iii) If a student does not clear one or more backlog course, he/she will have to appear as Ex-student along with regular examination in the next semester and fee will be charged at Rs. 750/- per paper, if the courses are listed for conducting the examination in that semester, otherwise, special fee of Rs. 1400/- per paper will be charged.

C. Other rules like maximum number of semesters, minimum passing marks, etc will be applicable as per rules.

3.9 Re-evaluation for answer book:

(i) (a) Re-evaluation is permissible only in Theory paper of semester's final examination.

(b) Re-evaluation is not permissible in the Answer Book of unfair means case(s).

(ii) The candidate may apply for re-evaluation within 11 days of the issue of the mark sheet on the prescribed form through Head of the institution depositing required fee and original mark-sheet. Incomplete and late submitted application shall not be considered.

(iii) The re-evaluation fee per paper shall be as prescribed and will not be refundable on any pretext.

(iv) Re-evaluation shall be done by an examiner of the subject to be appointed by the Vice-Chancellor.

(v) If the marks obtained after re-evaluation increase/decrease within 20% of the maximum marks prescribed for the paper, the same will be taken as marks obtained after re-evolution. However, if the marks awarded by the re-evaluation increase/decrease by more than 20% of maximum marks prescribed for the paper then the answer book will be referred to the second re-evaluation and the average of two closest awarded marks (the middle award in case the three awards if uniformly spread) shall be taken as the marks obtained after re-evaluation and shall be awarded. However, a student who was declared Pass prior to re-evaluation and fails after re-evaluation, shall be awarded minimum pass marks.

(vi) Marks awarded after re-evaluation of the paper will be considered for award of merit.

(vii) (a) No one shall be admitted in the next higher class and considered for any beneficial claim only on account of submission of application of the re-evaluation of Answer Book(s) in the office.

(b) A student becoming eligible for admission on account of result of re-evaluation may be admitted in next higher class without late fee. He will be required to pay full fees for the year within 7 days of declaration of the result. Attendance in such case shall be counted from the date of admission.

3.10 Moderation of Results:

The result committee shall also act as Moderation Committee to review the results for the normal distribution of marks, the percentage of pass and failure. Any moderation suggested in a paper shall be uniformly applied to all the students registered in that paper, with the approval of the Vice-Chancellor. Any moderation effected should not be more than 10% of maximum marks in a paper. However, if after moderation or otherwise, if a student is failing only by one mark in a paper, Controller of Examinations may award one grace mark to pass the student in that paper.

4.0 GENERAL RULES PERTAINING TO EXAMINATIONS

4.1 A student who has been deputed by College/University authorities to represent at a national/international meet/ championship/tournament/extra curricular activities, does not appear in the final examination due to such participation, may be permitted to take missing paper(s) at next main examination, when such course(s) are regularly offered as a special case. He/she, however, will be required to seek prior permission from the Vice-Chancellor.

4.2 No special examination shall be held for students who miss the examination on account of police custody, court attendance or fail to attend for other reason, whatsoever.

4.3 Examinations will not be postponed due to failure of electricity.

4.4 The boycotted and walked out papers shall not be recounted. This authority rests only with the Chancellor of the university.

5.0 PRACTICAL WORK EXPERIENCE REQUIREMENTS

After successful completion of all the courses including practical trainings with minimum OGPA of 5.0, a student will become eligible for the degree.

Details of practical training (Training in factory, workshop, mine, engineering works/design, office etc.) which students are to undertake in different degree programmes is given below:

	Branch of Engineering	Duration	Year
(a)	Agriculture*	Four weeks each	At the end of II & III year
(b)	Mechanical	30 + 30 = 60 days	- do -
(c)	Mining**	30 + 30 = 60 days	- do -
(d)	Electrical	30 + 30 = 60 days	- do -
(e)	Computer Science & Engg.	30 + 30 = 60 days	- do -
(f)	Electronics & Communication	30 + 30 = 60 days	- do -
(g)	Information Technology	30 + 30 = 60 days	- do-
(h)	Civil Engineering	30 + 30 = 60 days	- do-

***** *In addition to the above the agricultural engineering graduates have to undergo "Student READY Rural and Entrepreneurship Awareness Development Yojana", which includes 8 weeks Industrial attachment/ Internship (Student READY) and 8 weeks Experiential learning on campus (Student READY) in the first semester of final year B.Tech. (Ag.). Also, a student has to undergo an educational tour.*

In order to take policy decision and to solve the operational and administrative bottleneck, if any, there shall be a college level committee consisting of the followings. The committee will guide in selection of elective courses and experiential learning/project.

Senior most Head of the Department	-	*Convener*
Heads of concerned Department	-	*Member*
Training Officer	-	*Member*
Class Advisor of IV year	-	*Member*

Procedure for evaluating the students on all the above practical trainings will be followed as prescribed.

** *The Mining Engineering students shall have to undergo 12 days mining camp at the end of I semester of II year and 12 days survey camp at the end of I semester of III year, in addition to 60 days practical training.*

6.0 ATTENDANCE REQUIREMENTS

6.1 The student shall be permitted to appear in the university main examination only if a minimum attendance of 75% is maintained separately in theory and practical in each course from the date of registration in that course. However, in NCC/NSS/NSO/YOGA the minimum attendance requirement would be 65%. In case of sickness or any other valid reasons, the Vice-Chancellor may condone the attendance to an extent of 10%.

6.2 A student who is short of attendance in one or more courses will be detained form appearing in the final semester examination of all such course(s) and will be awarded zero grade point. Such courses shall be denoted by letter "DE" in the mark sheet.

6.3 En-mass absence shall be treated as absent in the attendance record of the students and will be charged a fine of Rs. 2000/- on en-mass cutting of the classes for more than 3 days.

6.4 The registration of the student shall be cancelled if he/she remains absent from the college in any one subject (i.e. any particular course for which a student is registered in that semester) for more than seven days without prior permission. He/she would be re-registered on tendering apology to the effect that he/she will not repeat such absence in future within seven days of the cancellation of the registration by paying a fine of D 250/- or within 15 days by paying a fine of D 500/- or within one month by paying D 1000/-, respectively.

6.5 If a student who has been admitted to the 1st semester of a programme and fails to attend the classes continuously for a period of 30 days without the permission of the Dean of the college, the name of such a student will be removed from the college roll. No petition is permitted in this case. He/she may have to seek re-admission as a fresh candidate.

6.6 If a regular student of the college in subsequent semester fails to register on schedule time or fails to attend the class after registration continuously for 30 days without the permission of the Dean of the college, the student will be removed from the college roll and parents informed accordingly. A student so removed may apply to the Dean within 15 days of his/her removal for reconsideration for re-registration in the next academic session, giving valid and strong reasons for failing to take permission. His removal may be revoked, provided that, his/her advisor is satisfied with the performance of the student and the same is approved by the Dean. The period of removal shall be counted towards the number of semester, though no grade/marks would be awarded for this semester.

7.0 ADVISORY SYSTEM

Student will be required to report to the respective class advisors for getting registration form and examination form for the purpose of registration. Class advisors will also be responsible for distribution of marks sheet obtained from the university.

8.0 SYMBOLS AND THEIR MEANING

Following symbols would be used to designate the status of the student:

Symbol	Significance
F	Fail
DE	Detained
UM	Unfairmeans
R	Repeat

Note - *All such courses which are cleared by repeating the same or repeated for improvement of OGPA to bring it to the minimum required level shall be marked by letter 'R' in the transcript.*

9.0 WITHDRAWAL FROM SEMESTER

(a) A student shall be permitted to withdraw from a semester only two times in the degree programme, on the grounds of ill-health and personal exigencies subject to the condition that the reasons for withdrawal are convincing. For this the student has to submit a written request at least one week prior to the commencement of the main examination of the semester from which the student wants to withdraw.

(b) A student who has withdrawn from a semester has to join the same semester during next year.

(c) The period lost due to withdrawal (one year for one withdrawal) shall not be counted towards maximum permissible period for which a student can remain on the college roll.

10.0 EXAMINATION OF PRACTICAL TRAINING, PROJECT AND SEMINAR

(a) For the examination of practical training (including industry visit, mining camp, survey camp, etc.) there will be an internal board appointed by the Dean. The board will comprise of concerned Head of the Department as chairman and one or two teachers of the concerned department(s) as members. The marks will be awarded on the basis of work report, practical record, quiz, Viva-voce, etc. and added to the marks list in the Final year's examination.

(b) For project viva-voce examination there shall be a Board of examiners consisting of project committee and one/two external examiners. The concerned Head of the Department will be the Chairman of the committee. However, in Agriculture Engineering discipline, the Chairman will be the Project Chairman. The Chairman will then nominate two teachers as members. The Board may meet in one or two meetings according to the availability of external examiner(s). A candidate will be assessed for the work done during semester by the Project Advisor and the Project Committee.

As the project is assigned in the first semester of the final year and the student works on it during both the semesters the assessment of the project shall be done in both the semesters. The internal viva-voce of first semester and both the seminars shall be assessed by the Project Committee. However the marks shall be counted in the second semester only. The distribution of marks shall be as follows :

Particulars	I Semester	II Semester	Total
Day-to-day assessment by the major advisor	15	20	35
Seminar	10	15	25
Viva-voce	10 (Internal)	30 (External)	40
TOTAL	35	65	100

(c) For seminar, wherever prescribed as a course of study, there shall be a board of examiners consisting of the Head of the Department as chairman and two teachers of the department.

11.0 CHANGE OF BRANCH OF STUDY IN SECOND YEAR B.TECH.

The students, in the second year, can avail one opportunity to change their branch of study on merit basis in accordance with rules framed by the university from time to time.

12.0 ADMISSION OF DIPLOMA STUDENTS IN SECOND YEAR B.TECH.

The diploma holders from the Board of Technical Education, Rajasthan with 10+2 qualification can seek direct admission in second year B.Tech. The number of seats, admission procedure, educational and other requirement would be as specified by the Government and/or approved by the university from time to time.

13.0 GRADUATION REQUIREMENT AND AWARD OF DIVISION

(a) A student shall be awarded degree only if he has passed all the courses and completed other requirements prescribed for the programme and secured an OGPA of 5.00 or above.

(b) The division of the student shall be determined by the OGPA at the end of successful completion of the program as follows :

Division	OGPA
First	6.00 and above
Second	5.00 to 5.99

SCHEME OF TEACHING AND EXAMINATION
Bachelor of Technology (Agriculture)
First Year B.Tech. (Common for All Branches)

I-SEMESTER

Course No.	Title		Credit		Hours/ Week		Marks		
			Th.	P	L	P	Th.	P	MT
BS 111	Mathematics – I		3	0	3	0	80	-	20
ME 113	Mechanical Engg. - I		3	0	3	0	80	-	20
ME 114	Workshop Practice		0	1	0	3	0	80	20
CE 115	Engineering Drawing		0	1	0	3	0	80	20
	NCC/NSS/NSO/Yoga[1]		-	-	0	2	-	-	-
	Total		**6**	**2**	**6**	**8**	**160**	**160**	**80**
GROUP I									
BS100P	Engineering Physics		2	1	2	2	50	30	20
CE 100	Engineering Mechanics		2	1	2	2	50	30	20
EE 100	Electrical Engg. – I		3	1	3	2	50	30	20
REE 100	Environmental Studies and Disaster Management		2	0	2	0	80	-	20
	Total		**9**	**3**	**9**	**6**	**230**	**90**	**80**
GROUP II									
BS100C	Engineering Chemistry		2	1	2	2	50	30	20
EC 100	Electronics and Instrumentation		2	1	2	2	50	30	20
CS 100	Introduction to Computer Programming and Data Structure		2	1	2	2	50	30	20
BS100E	Communication Skills and Personality Development[2]		2	1	2	2	50	30	20
	Total		**8**	**4**	**8**	**8**	**200**	**120**	**80**
	Total	Group-I	15	5	15	14	–	–	–
		Group-II	14	6	14	16			
Total Credits/Hours/Marks		**Group-I**	**20**			**29**		**800**	
		Group-II	**20**			**30**			

[1] NCC/NSS/NSO/Yoga is compulsory non-credit and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

[2] The examination (Theory and Lab) shall be conducted internally by the college.

Note: *The courses BS 100P, CE 100, EE 100, REE 100, BS100C, EC 100, CS 100 and BS 100E shall be offered in both the semesters. The students will be divided in two groups in I semester itself and shall remain in the same group in II semester as well. However, they have to offer all the eight courses in first year.*

II-SEMESTER

Course No.	Title		Credit		Hours/ Week		Marks		
			Th.	P	L	P	Th.	P	MT
BS 121	Mathematics - II		3	0	3	0	80	-	20
CE 122	Civil Engineering		1	1	1	2	50	30	20
ME 123	**Machine Drawing - I**		0	1	0	3	0	80	20
ME 124	Workshop Technology		2	1	2	3	50	30	20
	NCC/NSS/NSO/Yoga[1]		-	-	0	2	-	-	-
	Total		**6**	**3**	**6**	**10**	**180**	**140**	**80**
GROUP I									
BS 100C	Engineering Chemistry		2	1	2	2	50	30	20
EC 100	Electronics and Instrumentation		2	1	2	2	50	30	20
CS 100	Introduction to Computer Programming and Data Structure		2	1	2	2	50	30	20
BS 100E	Communication Skills and Personality Development[2]		2	1	2	2	50	30	20
	Total		**8**	**4**	**8**	**8**	**200**	**120**	**80**
GROUP II									
BS100P	Engineering Physics		2	1	2	2	50	30	20
CE 100	Engineering Mechanics		2	1	2	2	50	30	20
EE 100	Electrical Engg. – I		3	1	3	2	50	30	20
REE 100	Environmental Studies and Disaster Management		2	0	2	0	80	-	20
			9	3	9	6	230	90	80
	Total	Group I	14	7	14	18	-	-	-
		Group II	15	6	15	16			
Total Credits/ Hours/Marks		Group I	**21**			**32**		**800**	
		Group II	**21**			**31**			

[1] NCC/NSS/NSO/Yoga is compulsory non-credit and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

[2] The examination (Theory and Lab) shall be conducted internally by the college.

SECOND YEAR B. Tech.

III-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th	P	L	T	P	Th	P	MT
BS 211 (All Branches)	Mathematics - III	3	0	3	0	0	80	-	20
AG 213	Fundamentals of Agriculture	3	1	3	0	2	50	30	20
CE 211 (CE,AE,EE,MI)	Strength of Materials	2	1	2	1	2	50	30	20
CE 212 (AE)	Fluid Mechanics and open Channel Hydraulics	2	1	2	0	2	50	30	20
ME 215 (AE)	Heat Transfer, Refrigeration and Air Conditioning	2	1	2	0	2	50	30	20
REE 211	Fundamental of Renewal Energy Sources	2	1	2	0	2	50	30	20
SWE 211	Watershed Hydrology	1	1	1	0	2	50	30	20
	NSS/NCC/NSO/Yoga[1]	-	-	0	0	2	-	-	-
	Total	15	6	15	1	14	-	-	-
Total Credits/Hours/Marks		**21**		**30**			**700**		

T - Tutorials do not carry any credit

IV-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
CE 222 (AE)	Surveying and Levelling	1	2	1	0	6	50	30	20
CE 223 (AE)	Soil Mechanics	2	1	2	0	2	50	30	20
ME 223 (AE)	Auto CAD application	0	2	0	0	4	-	80	20
FMP 221	Tractor and Automotive Engines	2	1	2	0	2	50	30	20
CS 226 (AE)	Web Designing and Internet Applications	1	1	1	0	2	50	30	20
SWE 221	Irrigation Engineering* and Sprinkler and Micro Irrigation Systems	3	1	3	0	2	50	30	20
SWE 222	Soil and Water Conservation Engineering	2	1	2	0	2	50	30	20
ME 224 (AE)	Theory and Design of Machines	3	0	3	0	0	80	-	20
	NSS/NCC/NSO/Yoga[1]	-	-	0	0	2	-	-	-
	Total	14	9	14	0	22	-	-	-
Total Credits/Hours/Marks		**23**		**36**			**800**		
Skill Development Training I in summer break June-July after IV Semester (Student READY)									

[1] NSS/NCC/NSO/Yoga is compulsory non-credit and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

Note: *Students have to undergo a practical training of four weeks at the end of IV semester during summer break for which the assessment will be made at the beginning of the next semester.*

THIRD YEAR B.Tech.

V-SEMESTER

Course No	Title	Credit		Hours/ Week			Marks		
		Th	P	L	T	P	Th	P	MT
FMP 311	Farm Machinery and Equipment – I	2	1	2	0	2	50	30	20
CE 313 (AE)	Building Construction and Cost Estimation	2	0	2	0	0	80	-	20
FMP 312	Tractor Systems and Controls	2	1	2	0	2	50	30	20
PFE 311	Post Harvest Engineering of Cereals, Pulses , Oil seeds	2	1	2	0	2	50	30	20
SWE 311	Watershed Planning and Management	1	1	1	0	2	50	30	20
SWE 312	Groundwater, Wells and Pumps	2	1	2	0	2	50	30	20
REE 311	Renewal Power Sources	2	1	2	0	2	50	30	20
PFE 312	Engineering Properties of Agricultural Produce	1	1	1	0	2	50	30	20
AE 311	Skill Development Training I (Student READY) Registration Only	0	5	0	0	-	0	100	0
	Total	14	12	14	0	14	-	-	-
Total Credits/Marks/Hours		**26**		**28**			**900**		

T - Tutorials do not carry any credit

VI-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
FMP 321	Farm Machinery and Equipment–II	2	1	2	0	2	50	30	20
PFE321	Food Packaging Technology	2	1	2	2	2	50	30	20
SWE 321	Water Harvesting and Soil Conservation Structures	2	1	2	0	2	50	30	20
SWE 322	Drainage Engineering	1	1	1	0	2	50	30	20
FMP 322	Tractor and Farm Machinery Operation and Maintenance	0	2	0	0	4	0	80	20
PFE 322	Dairy and Food Engineering	2	1	2	0	2	50	30	20
REE 321	Bio-energy Systems: Design and Applications	2	1	2	0	2	50	30	20
CE 322 (AE)	Design of structures	2	0	2	0	0	50	30	20
	Total	**13**	**8**	**13**	**2**	**16**			
Total Credits/Hours/Marks		**21**		**31**			**800**		
Skill Development Training II in summer break June-July after VI Semester (Student READY)									

Note: *Students have to undergo a practical training of four weeks at the end of VI semester during summer break for which the assessment will be made at the beginning of the next semester.*

FOURTH YEAR B.Tech.

VII-SEMESTER

Course No.	Student READY (Rural and Entrepreneurship Awareness Development Yojana)								
	Title	Credit		Hours/ Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
AE411	08 weeks Industrial* Attachment/Internship (Student READY)	0	10					100	
AE412	08 weeks experiential learning on campus** (Student READY)	0	10					100	
AE413	Skill Development Training II (Student READY) Registration only	0	5					100	
AE414	Educational Tour (Registration only)	0	2					100	
	Total	**0**	**27**					**400**	
	Educational Tour during Winter/January break								

***** The students will be required to have hands-on-experience at progressive farms, research institutions, manufacturing or agro-processing industries and in rural areas.

****** The experiential learning is intended to build practical skills and entrepreneurship among the graduates with aim to deal with work situations and for better employability and self employment. It will involve setting-up of model plans for food processing and value addition for product diversification, setting up of workshops for manufacturing, operation and maintenance of farm machinery and equipment, maintenance and custom hiring of farm machinery and equipment. Exposure to Renewable Energy Technologies & Processes. Exposure to Planning, Designing & Estimations of Soil & Water Conservation Measures & Watershed Management.

VIII-SEMESTER

Student READY (Rural and Entrepreneurship Awareness Development Yojana)									
Course No.	Title	Credit		Hours/ Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
	Elective Course*	2	1	2	0	2	50	30	20
	Elective Course*	2	1	2	0	2	50	30	20
	Elective Course*	2	1	2	0	2	50	30	20
AE421	Entrepreneurship Development and Business Management	2	1	2	0	2	50	30	20
AE422	Project Planning and Report Writing (Student READY)	0	10	0	0	-	0	100	0
	Total	8	14	8	0	8	200	220	80
	Total Credits/Hours/Marks	**22**					**500**		

*** Student will have to take minimum of 09 credits courses from the following list**

Course No.	Title	Credit		Hours/Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
PFE 421	Food Quality and Control	2	1	2	0	2	50	30	20
PFE 422	Food Plant Design and Management	2	1	2	0	2	50	30	20
PFE 423	Agricultural Structures and Environmental Control	2	1	2	0	2	50	30	20
PFE 424	Development of Processed Products	2	1	2	0	2	50	30	20
PFE 425	Process Equipment Design	2	1	2	0	2	50	30	20
PFE 426	Post Harvest Engineering of Horticulture Crops	2	1	2	0	2	50	30	20
SWE 421	Floods and Control Measures	2	1	2	0	2	50	30	20
SWE 422	Wasteland Development	2	1	2	0	2	50	30	20
SWE 423	Remote Sensing and GIS Applications	2	1	2	0	2	50	30	20
SWE 424	Management of Canal Irrigation System	2	1	2	0	2	50	30	20
SWE 425	Minor Irrigation and Command Area Development	2	1	2	0	2	50	30	20

Course No.	Title	Credit		Hours/Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
SWE 426	Landscape Irrigation Design and Management	2	1	2	0	2	50	30	20
SWE 427	Plastic Applications in Agriculture	2	1	2	0	2	50	30	20
FMP 421	Mechanics of Tillage and Traction	2	1	2	0	2	50	30	20
FMP 422	Farm Machinery Design and Production	2	1	2	0	2	50	30	20
FMP 423	Tractor Design and Testing	2	1	2	0	2	50	30	20
FMP 424	Hydraulic Drive and Controls	2	1	2	0	2	50	30	20
FMP 425	Pesticides Application and Equipment	2	1	2	0	2	50	30	20
FMP 426	Human Engineering and Safety	2	1	2	0	2	50	30	20
FMP 427	Precision Farming Techniques for Protected Cultivation	2	1	2	0	2	50	30	20
REE 421	Photovoltaic Technology and Systems	2	1	2	0	2	50	30	20
REE 422	Waste and By-products Utilization	2	1	2	0	2	50	30	20

TOTAL CREDITS DISTRIBUTION
Semester Wise

SEMESTER		Th	Pr	Total	Remarks
I	Group I	15	5	20	
	Group II	14	6	20	
II	Group I	14	7	21	
	Group II	15	6	21	
III		15	06	21	
IV		14	09	23	
V		14	12	26	(21+05*)
VI		13	08	21	
VII		0	27	27	(22+5*)
VIII		8	14	22	
Total				**181**	

*Skill development training in summers

Total Credit: 181

COURSE CONTENT

FIRST YEAR B.TECH. (I SEMESTER)

BS 111 MATHEMATICS – I

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome: At the end of the course, the student will be able to:

CO1 Expand function in Taylor's and Maclaurin's series

CO2 Trace the Cartesian and Polar curves

CO3 The student will be able to apply the partial differentiation to compute the minima and maxima of functions of two variables.

CO4 The student will be able to compute areas and volumes by integration.

CO5 Solve linear differential equations of higher order and homogenous differential equations with constant coefficients.

Unit-I

Differential Calculus: Taylor's and Maclaurin's expansions, Asymptotes and Curvature (Cartesian Coordinates only), Curve tracing (Cartesian and standard Polar Curves- Cardioids, Lemniscates of Bernoulli, Limacon, Equiangular Spiral).

Unit-II

Differential Calculus: Partial Differentiation, Euler's Theorem on Homogeneous Functions, Maxima & Minima of Two Independent Variables, Lagrange's Method of Multipliers, Jacobians.

Unit-III

Integral Calculus: Double Integral, Areas & Volumes by Double Integration, Change of Order of Integration, Triple integrals, Beta Function and Gamma Function (Simple Properties), Relation between Beta and Gamma functions.

Unit-IV

Differential Equations: Linear Differential Equations of Higher Order with constant coefficients, Homogeneous Linear Differential Equations with constant coefficient.

Text Books/References

1. Guar, Y.N. and Koul, C.l. (2013) Engineering Mathematics, Vols. I & II, Jaipur Publishing House, Jaipur.
2. Babu Ram (2011) Engineering Mathematics-I, Pearson Education, India.

3. B.V. Ramana (2012) Higher Engineering Mathematics, Tata McGraw Hill, India.
4. J.L. Bansal and H.S. Dhami (2012) Differential Equations, Vols. I & II, Jaipur Publishing House, Jaipur.
5. M. Ray and Chaturvedi: A Text Book of Differential Equations, Student Friend & Co. Publisher, Agra.
6. Rao V. Dukkipati (2012) Engineering Mathematics, New Age International (P) Ltd., New Delhi.

ME 113 MECHANICAL ENGINEERING

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome: At the end of the course, the student will be able to:

CO1 A fundamental understanding of the laws of thermodynamics and their application to a wide range of systems with work and heat interactions.

CO2 Concept of entropy and irreversibility of a process and application of thermodynamic relationships to solve practical problems.

CO3 Gas and vapour power cycles and the efficiencies.

CO4 Properties of steam and its application in power generation.

CO5 Construction and working of various boilers and IC engines.

Unit-I

Thermodynamics: Thermodynamic properties, closed and open systems, flow and non-flow processes, gas laws, laws of thermodynamics, internal energy. Application of First Law in heating and expansion of gases in non-flow processes only.

Second law of thermodynamics: Kelvin-Planck and Claussius statements. Reversible processes, Carnot cycle, Carnot theorem. Reverse Carnot cycle. Entropy, physical concept of entropy.

Unit-II

Properties of Steam: Difference between gas and vapour, change of phase during constant pressure process. Generation of Steam, triple point and critical point. Internal energy and entropy of steam. Use of steam tables and Mollier chart, heating and expansion of vapour in non-flow processes.

Unit-III

Vapour Power Cycles: Introduction to Carnot Cycle. Rankine cycle and modified Rankine cycle.

Steam Generators: Classification of steam boilers. Cochran, Lancashire, Locomotive and Babcock-Wilcox boilers. Boiler mountings and accessories.

Steam Engines: Introduction to simple and compound steam engines.

Unit-IV

Gas Power Cycles: Introduction. Air Standard efficiency, other engine efficiencies and terms. Otto, Diesel and Dual cycles. Calculation of efficiency, mean effective pressure and their comparison.

Internal Combustion Engines: Introduction, Classification, terminology and description of IC Engines. Four stroke and two stroke petrol, gas and diesel engines. Comparison of petrol and diesel engines. Simple carburettor.

Text Books/References

1. M.L. Mathur and F.S. Mehta: Thermal Engineering, (Vol. I, SI Edition), Jain Brothers, New Delhi.
2. R.K. Purohit: Foundation of Mechanical Engineering, Scientific Publishers (India), Jodhpur.
3. P.K. Nag: Engineering Thermodynamics, TMH.

ME 114 WORKSHOP PRACTICE

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**3**

Course Outcome: At the end of the course, the student will be able to:

CO1	Practical performance in carpentry shop.
CO2	Smithy Shop, Simple exercises involving basic operations like bending, drawing, punching, shaping, upsetting and riveting.
CO3	Fitting Shop, Simple exercises involving basic operations like sawing, chipping, filling, drilling, reaming, threading with taps and dies.
CO4	Sheet Metal and Plumbing Shop, Demonstration of basic tools, pipe fittings and operations.

Carpentry Shop: Acquaintance with types of wood, tools and their uses. Simple exercises involving basic operations like sawing, planning, chiselling, etc. Preparation of simple joints, cross half lap joint, dovetail joint, bridle joint, tennon and mortise joint.

Smithy Shop: Acquaintance with types of tools and their uses. Simple exercises involving basic operations like bending, drawing, punching, shaping, upsetting and riveting.

Fitting Shop: Acquaintance with tools, measuring and marking tools, precision measuring tools and their uses. Simple exercises involving basic operations like sawing, chipping, filling, drilling, reaming, threading with taps and dies.

Sheet Metal and Plumbing Shop: Demonstration of basic tools, pipe fittings and operations.

Texts/References

1. S. K. Hajra Choudhury and AK Hajra Choudhury. Elements of Workshop Technology (Vol. I), Media Promoters & Publishers Pvt. Ltd., Bombay.

CE 115 ENGINEERING DRAWING

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**3**

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

CO1	Select, Construct and Interpret appropriate drawing scale as per the situation.
CO2	Draw simple curves like ellipse, cycloid and spiral.
CO3	Draw Orthographic projections of points, lines and planes.
CO4	Draw orthographic projection of solids like cylinders, cones, prisms and pyramids including sections.
CO5	Layout development of surface of solids for practical situations.
CO6	Draw isometric projections of simple objects.

Introduction and letter writing. Construction and use of plain, diagonal and vernier scale. Methods of drawing ellipse, parabola and hyperbola. Methods of drawing cycloids, spirals. Orthographic projection and projection of points.

Projection of lines, projection of planes, projection of solids. Introduction of prism, pyramid, cylinder and cone.

Section of solids, introduction of intersection of surfaces. Development of plane and curved surface. Isometric projection.

Texts/References

1. N.D. Bhatt, Elementary Engg. Drawing, Rupalee publication, Anand.
2. Lakshmi Narayan and Vaishwanar. A Text Book of Practical Geometry, Jain Brother, New Delhi.
3. R.B. Gupta. A Text Book of Engineering Drawing, Satya Prakashan, New Delhi.
4. Fundamentals of Technical Drawing, Parkinson.

BS 100P ENGINEERING PHYSICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1 Apply vector calculus approach to problems in electric field and magnetic field.

CO2 Apply laws of physics to simple LRC circuits.

CO3 Learn physics behind various types of lasers and their characteristics.

CO4 Understand the interference and diffraction from wave optics concepts and know its applications.

CO5 Understand polarization of light and its applications.

Unit-I

Electric Field: Line integral of electric field, Potential difference, Field as gradient of potential, Divergence of a vector function, Differential form of Gauss's law, Laplacian, Laplace equations, Curl of a vector function. Gauss's divergence theorem.

Magnetic Field: Curl and Divergence of a magnetic field, Magnetic scalar and vector potential.

Unit-II

Varying Field: Faraday's law-integral and differential form, Self and mutual inductance, Neumann's equation, Charge and discharge of a capacitor through register, Growth and decay of current in LR circuit, Energy stored in electric and magnetic field, Displacement current, Maxwell's equations.

Unit-III

Laser: Coherence, Einstein's coefficient, Spontaneous and stimulated emission, Population inversion, Laser gain (pumping), Spectral narrowing in laser, Coherence length, Ruby and He-Ne laser.

Interference: Division of amplitude, colour of thin films, Newton's ring, Febry-Perot interferometer-principle, operation, determination of wave length and difference in wave length.

Unit-IV

Diffraction: Double slit Fraunhofer diffraction pattern, Fraunhofer diffraction by a plane transmission grating, Formation of spectra.

Polarization: Analysis of linearly, circularly and elliptically polarized light (Half wave and quarter wave plates), Optical activity, specific rotations, Laurent's half shade and its use for determination of specific rotation of sugar solution.

Practicals

1. To find refractive index and dispersive power of material of prism by spectrometer.
2. To find wave length of light by Newton's ring.
3. To find wave length of light by diffraction grating.
4. To find specific rotation of sugar solution by polarimeter.
5. To find wave length of light by Fresnel Biprism.
6. To find frequency of A.C. mains.
7. To determine dielectric constant of liquid using series resonance method.
8. To study charge and discharge of condenser through a resistor (C.R. Circuit).
9. To study LCR resonant circuit, resonance, quality factor and sharpness in (i) series circuit (ii) parallel circuit.

Text Books/References

1. K.K. Tiwari. (1995). Electricity and Magnetism, S. Chand and Company, New Delhi.
2. N. Subrahmanyam and Brijlal. (1993). A Text Book of Optics, S. Chand and Company, New Delhi.
3. Ahmed and Lal. (1966). Electricity, Magnetism and Electronics, Unitech House, Lucknow.
4. D.S. Mathur. (1993). Mechanics, S. Chand and Company, New Delhi.
5. Gupta and Kumar. (1995). Practical Physics, Pragati Prakashan, Meerut.

CE 100 ENGINEERING MECHANICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1 Draw free body diagrams and determine the resultant of forces and/or moments.

CO2 Determine the centroid and second moment of area of sections.

CO3 Apply laws of mechanics to determine efficiency of simple machines with consideration of friction.

CO4 Analyse statically determinate planar frames.

CO5 Analyse the motion and calculate trajectory characteristics.

CO6 Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies.

(A) STATICS

Unit-I

Introduction of condition of equilibrium: Force, system of force, coplanar forces.

Moment and couples: Moment and parallel forces, Couples, General conditions of equilibrium.

Practical Applications: Levers, Cracked levers, Steel yards. Sagging chains and toggle joints.

Centre of Gravity: Centre of parallel forces, C.G. in some simple cases, C.G. of Solids.

Moment of Inertia: Moment of inertia, Radius of gyration and perpendicular axis. Determination of moment of inertia of simple sections. Mass of moment of inertia.

Unit-II

Friction: Introduction, Critical angle of friction, Friction on horizontal planes, Friction on inclined planes, Wedge and block, Screw jacks, Rolling friction.

Machines: Introduction, Effects of friction, Loss of work, Reversible and irreversible machine, Law of machine, Wheel and axle, Differential wheel and axle, Pulley block, Screw jack, Single and double purchase crab, Worm and Worm wheel, System of pulleys.

Frames: Statically determinate plane frames, Method of joints, Method of sections, Graphical method.

(B) DYNAMICS

Unit-III

Rectilinear Motion, Motion under gravity, Projectiles equation of the path, Maximum height attained, Time of flight, Horizontal range. Angle of projection, Projectile from a given height, Projectile on an inclined plane, Problems.

Work, Power and Energy: Work, Power, Work done by torque, Energy, Law of conservation.

Unit-IV

Centripetal and centrifugal forces, Laws of motion: Newton's Law of motion and their explanation, Collision of elastic bodies; Impulse and impulsive force, Principle of conservation of momentum, Loss of kinetic energy during impact.

Practicals

1. Verification of law of polygon of forces.
2. Verification of principle of moment in case of compound level.
3. Verification of principle of moment in case of bell crack level.
4. Determination of reaction in case simply supported beam with or without overhang.
5. To determine coefficient of friction between different surfaces on horizontal plane.
6. To determine coefficient of friction between different surfaces in inclined plane.
7. Study of different wheel and axle.
8. Study of single purchase crab.
9. Study of worm and worm wheel.
10. Study of Weston's pulley block.
11. Determination of mechanical advantage, velocity ratio and efficiency of single purchase crab.
12. Determination of mechanical advantage, velocity ratio and efficiency of double purchase crab.
13. Determination of mechanical advantage, velocity ratio and efficiency of first system of pulley.
14. Determination of mechanical advantage, velocity ratio and efficiency of second system of pulleys.
15. Determination of mechanical advantage, velocity ratio and efficiency of third system of pulleys Flywheel.

Text Books/References

1. I.B. Prasad. Engineering Mechanics, Khanna Publisher, New Delhi.
2. R.S. Khurmi. Applied Mechanics, S. Chand & Company Ltd., New Delhi.
3. S.B. Junnarkar. Applied Mechanics, Charotar Publishing House, New Delhi.
4. Saluja. Applied Mechanics, Satya Prakashan, New Delhi.

EE 100 ELECTRICAL ENGINEERING – I

	Cr. Hrs.	4 (3 + 1)
	L	T	P
Credit	3	0	1
Hours	3	0	2

Course Outcome: At the end of the course, the student will be able to:

CO1 Proficiency in solving DC network.

CO2 Know-how of single phase AC circuits.

CO3 Competency in solving three phase balanced AC circuits.

CO4 Dexterity in using basic electrical instruments.

CO5 Comprehension of transformer working principles.

Unit-I

Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses.

Kirchoff's law, Delta-star and star-delta conversion, source conversion.

Network theorems: Thevenin's, Norton's, superposition and Maximum Power Transfer theorem.

Unit-II

Single Phase EMF generation, average and effective values of sinusoidal and linear periodic wave forms, instantaneous and average power, power factor, reactive & apparent power, solution of R-L-C, series, parallel, series-parallel circuits, complex representation of impedances, phasor diagram, series and parallel resonance.

Unit-III

Transformer*:* Faraday's laws of Electromagnetic induction, construction and principle operation of single phase transformer, EMF equation, voltage and current relationship and Phasor diagram for ideal transformer.

Fundamentals of DC machines: Working principle, operation and performance of DC machines (Motor and generator).

Unit-IV

Three phase A.C. circuits: Three phase EMF generation, delta and star connection, methods of three phase power measurement, power factor, reactive and apparent power, Series and parallel resonance.

Concept of Three phase induction motor: construction and operation

Basic introduction of single phase induction motor.

Practicals

1. To Establish the Voltage-Current Relationship in an Electric Circuit and to Measure the Unknown Resistance by Ammeter-Voltmeter Method (Ohm's Law).
2. Experimentally verify the number of resistance connected in series and parallel in an electric circuit can be replaced by in equivalent resistance without disturbing the circuit condition.
3. Verify Kirchhoff's current law and voltage law for a DC circuit.
4. Verify Superposition Theorem for a DC circuit.
5. Verify Thevenin's Theorem for a DC circuit.
6. To measure power and power factor in a single phase A.C. series R-L circuit.
7. Determination of Choke Coil parameter resistance (R) and inductance (L).
8. To study the characteristics of an L-C-R series circuit.
9. Testing of single phase energy meter by direct loading method.
10. Determination of percentage regulation of a single phase transformer by direct loading method.
11. Determination of efficiency of a single phase transformer by direct loading method
12. To perform open circuit and short circuit test for single phase transformer
13. To obtain load characteristics of D.C. shunt/series/compound generator
14. To perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent circuit parameters
15. To perform no load & blocked –rotor test on 1 ph. induction motor & to determine the parameters of equivalent circuit.

Text Books/References

1. B.L. Theraja. Electrical Technology, S. Chand.
2. M.E. Van Valkenberg. Network analysis, PHI
3. Soni and Gupta. Introduction to Electrical Network Theory, Dhanpat Rai Publisher
4. R.A. Gupta and Nikhil Gupta. (2002). Fundamentals of electrical & Electronics Engineering, JPH, Ist Edition,
5. H.P. Tiwari. (2002). Electrical & Electronics Engineering, College Book Centre, Jaipur.
6. J.B. Gupta. (2002). Fundamentals of Electrical & Electronics. S.K. Kataria and Sons, Dehli.

REE 100 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Cr. Hrs. 2 (2 + 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**0**	**0**

Course Outcome: At the end of the course, the student will be able to:

CO1 Develop an understanding of different natural resources including renewable resources.

CO2 Realize the importance of ecosystem and biodiversity for maintaining ecological balance.

CO3 Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.

CO4 Demonstrate an appreciation for need for sustainable development and role of science.

CO5 Aware of important acts and laws in respect of environment.

Unit-I

Environmental Studies: Definition, scope and importance. Natural Resources: Renewable and non-renewable resources and associated problems.

Forest resources: Use and over-exploitation. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects. Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.

Unit-II

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

Biodiversity and its conservation: Introduction, definition, genetic species & ecosystem diversity and biogeographical classification of India.

Value of biodiversity. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation.

Unit-III

Environmental Pollution: definition, cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards.

Solid Waste Management: causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Social Issues and the Environment: Urban problems related to energy; Water conservation, rain water harvesting, watershed management.

Environmental ethics: Issues and possible solutions; Wasteland reclamation, Consumerism and waste products. Environment Protection Act.

Issues involved in enforcement of environmental legislation. Public awareness, Human Population and the Environment: population growth, Family Welfare Programme.

Environment and human health: Human Rights, Value Education, HIV/AIDS, Women and Child Welfare.

Role of Information Technology in Environment and human health.

Unit-IV

Natural Disasters- Meaning and nature, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Climatic change: global warming, Sea level rise, ozone depletion.

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, accidents.

Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Armed forces in disaster response; Disaster response; Police and other organizations.

Suggested Readings

1. Agarwal K.C., Environmental Biology, Nidi Publications, Bikaner, 2001.
2. Bharucha Erach. 2005. Text Book of Environmental Studies for Undergraduate Courses, University Grants Commission, University Press, Hyderabad.
3. Chary Manohar and Jaya Ram Reddy. 2004. Principles of Environmental Studies, BS Publishers, Hyderabad.
4. Chaudhary, B.L. and Jitendra Pandey: Environmental Studies, Apex Publishing House, Udaipur, 2005
5. Climate Change.1995: Adaptation and mitigation of climate change-Scientific Technical Analysis Cambridge University Press, Cambridge.
6. Gupta P.K. 2004, Methods in Environmental Analysis – Water. Soil and Air. Agro bios, Jodhpur.
7. Husain Majid. 2013, Environment and Ecology: Biodiversity, Climate Change and Disaster Management, online book.
8. Jhadav, H. & Bhosale, V.M.: Environmental Protection & Laws, Himalaya Pub. House, Delhi
9. Kaul S.N., Ashuthosh Gautam. 2002. Water and Waste Water Analysis, Days Publishing House, Delhi.

10. Rao, M.N. and A.K. Datta, Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
11. Sharma J.P. 2003, Introduction to Environment Science, Lakshmi Publications.
12. Sharma, B.K., Environmental Chemistry, Goel Publishing House, Meerut
13. Sharma, R.K. & Sharma, G. 2005, Natural Disaster, APH Publishing Corporation, New Delhi.
14. Singh Pratap, N.S. Rathore and A.N. Mathur: Environmental Studies, Himanshu Publications, Udaipur, 2004.
15. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno Science Publications.

BS 100C ENGINEERING CHEMISTRY

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1 Demonstrate knowledge of science behind common impurities in water and methods to treat them.
CO2 Knowledge of methods to determine the calorific value of fuels, perform flue gas analysis and combustion analysis.
CO3 Apply the science for understanding corrosion and its prevention.
CO4 Demonstrate a knowledge of superconducting and organic electronic materials.
CO5 Knowledge of Kinetics of Reactions.

Unit-I

Sources of water, common impurities, requisites of drinking water in municipal water supply. Purification of water, sterilization, break point chlorination. Hardness, determination of hardness by Complexometric (EDTA) method, degree of hardness, Boiler troubles, carry over corrosion, Sludge and scale formation. Caustic embrittlement, cause of boiler troubles and their prevention.

Unit-II

Classification of fuels, solid fuels, Proximate and Ultimate analysis of coal, significance of constituents, theoretical method for calculation of Gross and net calorific values. Liquid fuels-Petroleum origin, Refining of Petroleum, knocking, octane number, anti-knocking agents. Flue gas analysis by Orsat-Apparatus, Calculations based on combustion.

Unit-III

Corrosion: Definition and its significance, Dry and Wet theories of corrosion, Cathodic & Anodic protection of corrosion, types of corrosion, factors affecting corrosion.

New Engineering Materials: Introduction, Properties and Applications of Super Condcutors, Organic electronic materials, Fullerenes.

Unit-IV

Chemical Kinetics: Order and Molecularity of reaction, first and second order reaction, Derivation of equations for first and second order reaction, determination of order of reaction, Energy of activation and Arrhenius equations, Numerical of first and second order reactions.

Engineering Chemistry Practicals

1. Determination of viscosity of a liquid.
2. Estimation of free chlorine in a water sample.
3. Determination of temporary and permanent hardness by EDTA method.
4. Determination of Copper Sulphate iodometrically.
5. Estimation of Potassium dichromate iodometrically.
6. Determination of purity of Ferrous Ammonium Sulphate (Mohr's Salt) using Potassium Permanganate.
7. Estimation of available chlorine in Bleaching Powder sample.
8. Analysis of Brass.
9. Determination of Strength of Ferrous Ammonium Sulphate (FAS) using Potassium Ferricyanide as an external indicator.
10. Analysis of Common Salt.

Text Books/References

1. Jain and Jain. Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Jain and Gupta. A Text Book of Engineering Chemistry, Jaipur Publishing House, Jaipur.
3. B.K. Sharma. Engg. Chemistry (General), Krishna Prakashan Media (P) Ltd., Merrut.
4. S.S. Dara. A Text Book of Engineering Chemistry, S. Chand & Co., New Delhi.
5. M.M. Uppal. A Text Book of Engineering Chemistry, Khanna Publishers, New Delhi.
6. S.S. Dara. A Text Book on Experiments and Calculations in Engg. Chemistry, S. Chand & Co., New Delhi.
7. Ameta and Yasmin. Practical Engineering Chemistry, Himanshu Publications, New Delhi.

EC 100 ELECTRONICS AND INSTRUMENTATION

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**1**

Course outcome

In this course students will be able to develop understanding of various electronic devices and circuits commonly used in engineering applications. The subject will also impart knowledge about working principle and hands on practice of common electronic instruments used in engineering applications.

Unit-I

Passive Components: Construction and characteristics of various types of resistors, capacitors & inductors for electronic circuits, color coding of resistors. Semiconductor Devices: Basic theory of semiconductors, constructions and characteristics of PN diode, Zener diode, photodiode, LED, BJT & JFET.

Unit-II

Bipolar Junction Transistor: Introduction to BJT biasing circuits, Basic concept of class-A, class-B, class-AB, class-C amplifiers.

Power supply: Rectifier circuits and filters. Concept of voltage regulators, Zener diode voltage regulators, Transistor series regulator.

Unit-III

Feedback & Oscillators: Concept of positive and negative feedback. Introduction to Oscillators. Barkhausen criteria. Working principle of RC- phase shift, Wien bridge, Hartley, Colpitts and Crystal Oscillators.

Unit-IV

Transducers: Active and Passive transducers. Working principle of Thermocouple, LVDT, Strain Gauge and Techo Generator. Instrumentation: Introduction to data acquisition system. Working principle of Electronic Multimeter, Cathode Ray Oscilloscope, Digital Storage Oscilloscope and Spectrum Analyzer.

LIST OF PRACTICAL EXPERIMENTS

1. Identification and testing of different types of passive and active electronic components: Resistors, Capacitors, Inductors, Diodes, Transistors.
2. Plot the V-I characteristics in forward and reverse bias mode for
   (a) PN junction diode
   (b) ZENER diode and find the cut-in and breakdown voltage respectively.
3. Plot the V-I characteristics of LED diode in forward bias mode and find the glow voltage.
4. Determine the R.M.S value of output voltage and check the waveform on CRO for:
   (a) Half wave rectifier with and without filter.
   (b) Full wave centre tapped rectifier with and without filter.
   (c) Full wave bridge rectifier with and without filter.
5. Plot the input and output characteristics for two configurations of transistors:
   (a) NPN/PNP transistor in CE configuration.
   (b) NPN/PNP transistor in CB configuration.
6. Determine both theoretically and practically the frequency of oscillation for R-C Phase shift Oscilloscope.
7. Determine the output voltage of an amplifier- (a) with feedback (b) without feedback.
8. Study and perform basic measurement of Digital Multi Meter.

9. Study and perform basic measurement of Cathode Ray Oscilloscope/Digital Storage Oscilloscope.
10. Study of Spectrum Analyzer and perform basic measurements.

NOTE: The actual number of experiments may be more than the above mentioned list.

Text Books/References

1. Millman and Halkias. Integrated electronics, McGraw Hill.
2. W.D. Cooper. Electronics Instrumentation and Measurement, PHI.
3. M.L. Gupta. Electrical Engineering Materials.
4. Melvin. Principles of Electronics.
5. John D. Ryder. Electronics Fundamentals.

CS 100 INTRODUCTION TO COMPUTER PROGRAMMING AND DATA STRUCTURE

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1 Understand the basic building blocks of a computer.
CO2 Learn the data types and syntax of C language.
CO3 Write, compile and execute programs in C language for solving engineering problems.
CO4 Demonstrate capability to choose appropriate type of data structures and perform operations on them.

Unit–I

Computer Fundamentals: History of computers; Organization of computers; input unit, output unit, storage unit, central processing unit, CPU operation, Memory subsystem- RAM, ROM, Cache memory, instruction execution cycle, Introduction to binary (Base-2) numbers.

Unit-II

Basics of programming in C: Constants, variables, data types, operators and expressions, input and output operations, decision making & branching- if-else, switch statement, decision making & looping- Arrays.

Unit-III

Character arrays & strings, user defined function, structures & unions, pointer management, dynamic memory allocation.

Unit–IV

Introduction to Data Structures: Introduction to linear arrays & representation of linear array in memory, traversing, insertion & deletion in linear arrays, Bubble sort, Linear & Binary search, Introduction to basic operations of stack such as push, pop, basic operation of queue such as insert, delete, basic operations of linked list such as traverse, insert, delete.

List of experiments/practicals

1. Write a C program to exhibit the use of various operators.
2. Write a C program to exhibit the use of if-else, switch in decision making.
3. Write a C program to exhibit the use of various loops and control statements.
4. Write a C program to exhibit the use of arrays, strings and pointers.
5. Write a C program to exhibit use of user defined functions, call by value, call by reference and recursion.
6. Write a C program to exhibit various storage classes.
7. Write a C program to exhibit the use of structure, union and dynamic memory allocation.
8. Write a C program to implement bubble sorting and searching algorithms (linear search, binary search).
9. Write a C program to exhibit stack and queue and their various operations.
10. Write a C program to understand singly linked list and its various operations (traverse, insert, delete).
11. The list of experimental mentioned above can be augmented based on the requirement by the subject teacher.

Text Books/References

1. E. Balagurusamy. “Programming in ANSI C”, Tata McGraw Hill.
2. Kernighan and Ritchie. “The C Programming language”, Prentice Hall
3. P.K. Sinha & P. Sinha. “Computer Fundamentals”, BPB Publication.
4. Seymour Lipschutz. “Data Structure”, Schaum’s outline series, McGraw Hill.

BS100E COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1	Understand basic grammar principles and be able to synthesise and transform sentences.
CO2	Write CVs, letters for job application, complaints and emails.
CO3	Prepare technical reports and short essays.
CO4	Learn phonetic symbols and use correct sound, stress and intonation.
CO5	Learn basic do’s and don’ts of an interview.
CO6	Show enhance communication ability in English.

Unit-I

Use of articles, Common Errors in English, Prepositions, Tenses, Concord, Narration and Voice.

Unit-II

E-mail Writing, Report Writing, Preparation of C.V And Resume Writing, Memo and Notice Writing.

Unit-III

Personality Traits, Skills for a good Leader, *Effective Time Management Techniques, Seminar, Conference and Group Discussion.*

Unit-IV

Communication, Process of Communication, Types of Communication, Barriers of Communication and Effective Communication.

PRACTICAL

Phonetic, Consonants, Vowels, Diphthongs, Homonyms and Homophones, Conducting Mock Interviews and Mock Gds, One - Word Substitutes, Synonyms and Antonyms, Idioms and Phrases.

SUGGESTED READINGS

1. Language in Use Upper intermediate Level, Adrian Doff Christopher Jones, Cambridge University Press
2. Common Errors in English, Abul Hashem, Ramesh Publishing House, New Delhi.
3. A Practical Course for Developing Writing Skills in English, J.K. Gangal, PHI Learning Pvt. Ltd., New Delhi.
4. Thomson and martin (1997), A Practical English Grammar Exercise Book, Vol. I and II, O.U.P. Publication.
5. Spoken English for India, R.K. Bansal & J.B. Harrison, Orient Longman, Delhi.
6. The sounds of English, Veena Kumar, Makaav Educational Software, New Delhi.
7. English Phonetics & Phonology, P. Roach, Cambridge University Press, London.
8. The Written Word, Vandana R. Singh, Oxford University Press (New Delhi).
9. English for Engineers, Made Easy, Aeda Abidi & Ritu Chaudhary, Cengage Learning, (New Delhi).
10. Daniel Coleman, Emotional Intelligence, Bantam Book, 2006.

FIRST YEAR B.TECH. (II SEMESTER)

BS 121 MATHEMATICS – II

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome: At the end of the course, the student will be able to:

CO1	Show knowledge of vector calculus and its applications in engineering.
CO2	Solve second order differential equations for application in their field of engineering.
CO3	Solve partial differential equations of first order and higher orders (with constant coefficients).
CO4	Solve simultaneous equations by matrix methods.
CO5	Determine eigenvalues and eigenvectors.
CO6	Diagonalise a matrix and invert a matrix.

Unit-I

Vectors Calculus: Scalar and Vector field, Differentiation of vector functions, Gradient, Divergence, Curl and Differential Operator, Integration of vector functions, Line, Surface and volume Integrals, Green's Theorem in a Plane, Gauss's and Stoke's Theorem (without proof) and their Applications.

Unit-II

Differential Equations: Second Order Ordinary Differential Equations with Variables Coefficients, Exact Forms, Part of Complimentary Function is known, Change of Dependent Variable, Change of Independent Variable, Normal Forms, Method of Variation of Parameter.

Unit-III

Partial Differential Equations: Formation of partial differential equations, Partial Differential Equations of First Order, Lagrange's Form, Standard Forms Higher order linear partial differential equations with constant coefficients.

Unit-IV

Matrices: Rank of a matrix, Inverse of a matrix by elementary transformations, Consistency and Solution of simultaneous linear equations, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), Diagonalization of matrix.

Text Books/References

1. Guar, Y.N. and Koul, C.I. (2013) Engineering Mathematics, Vols. I & II, Jaipur Publishing House, Jaipur.
2. Babu Ram (2011) Engineering Mathematics-I, Pearson Education, India.
3. B.V. Ramana (2012) Higher Engineering Mathematics, Tata McGraw Hill, India.
4. J.L. Bansal and H.S. Dhami (2012) Differential Equations, Vols. I & II, Jaipur Publishing House, Jaipur.
5. M. Ray and Chaturvedi, A Text Book of Differential Equations, Student Friend & Co. Publisher, Agra.
6. Rao V. Dukkipati (2012) Engineering Mathematics, New Age International (P) Ltd., New Delhi.

CE 122 CIVIL ENGINEERING

Cr. Hrs. 2 (1 + 1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1 Demonstrate knowledge of various surveying methods.

CO2 Conduct a chain survey.

CO3 Conduct a compass survey.

CO4 Conduct leveling survey and be able to do RL calculations.

CO5 Demonstrate knowledge of properties of various building materials.

(A) SURVEYING AND LEVELING

Unit-I

Principle and purpose of plane surveying.

Chain Surveying: Instrument for chaining, Direct & indirect ranging. Methods of chain along plane & sloping ground, Base line, check line, Tie line, Offset, Chain angle & recording in field book.

Compass Surveying: True & Magnetic meridian, whole circle bearing & quadrantal bearing system, construction & use of Prismatic & Surveyor Compass, Local attraction.

Unit-II

Level and leveling: Definition of various terms used in leveling. Types of Bench mark and their uses. Construction and use of Dumpy and Tilting levels, Leveling staves. Temporary adjustment of Dumpy level. Simple, differential leveling, fly leveling, longitudinal and cross sectioning, plotting of profile leveling. Determination of level by line of collimation and rise and fall method, Arithmetical checks. Level book and record keeping, leveling difficulties and errors in leveling.

(B) BUILDING MATERIAL

Unit-III

Stones: Different types, properties of good building stones, common testing of stones, Dressing of stones and use of stones in construction.

Bricks: Types, raw materials, identification, composition. Properties and uses of ordinary bricks, fire resistant and chemical resistant bricks.

Limes: Definition, sources of lime, slaking of lime, ISI classification of lime.

Unit-IV

Cement: Chemical composition, types of cement, properties, uses and tests on cement.

Mortars: Proportioning, properties of ingredients and use of lime, cement and gauge mortars.

Cement Concrete: Ingredients, common proportions, properties of fresh hardened concrete, Water cement ratio, curing and consolidation of concrete.

Practicals

1. Study of accessories used in measurement of distances.
2. Ranging Direct and indirect and use of chain and tape.
3. Chining along sloping ground.
4. Chain surveying, field book recording and taking offsets for location details.
5. Study of prismatic and surveying compass and taking bearings.
6. Study of Dumpy level, temporary adjustment and R.L. calculations.
7. Study of Tilting level, temporary adjustment and R.L. calculations.
8. Simply and differential leveling operation, record in level book, practice for staff reading line of collimation and Rise and fall method calculations.
9. L-section and cross sectioning, fly leveling operation.
10. Plotting of working profile.

Text Books/References

1. S.C. Rangwala. Engineering Materials, Charotar Book Stall, Anand.
2. B.C. Punmiya. Surveying & Field Work (Vol. I), Laxmi publications, New Delhi.

ME 123 MACHINE DRAWING – I

Cr. Hrs. 1 (0 + 1)

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	L	T	P
Credit	**0**	**0**	**1**
Hours	**0**	**0**	**3**

Course Outcome: At the end of the course, the student will be able to:

CO1 Introduction to BIS codes.

CO2 Introduction to Orthographic Projection.

CO3 How to draw the missing views and Sectional Views.

CO4 Knowledge about Riveted and Welded Joints, Screw Fastenings.

CO5 Knowledge of conventional representation of threads, different types of lock nuts, studs, machine screws, cap screws and wood screws.

Introduction, conventional representation of different materials used in machine drawing, Introduction to BIS codes.

Orthographic Projection: First and third angle methods of projection. Preparation of working drawing from models and isometric views. Drawing of missing views.

Dimensioning: Different methods of dimensioning.

Sectional Views: Concept of sectioning. Revolved and oblique section. Sectional drawing of simple machine parts.

Riveted and Welded Joints: Types of rivet heads and riveted joints. Processes for producing leak proof joints. Symbols for different types of welded joints.

Screw Fastenings: Nomenclature, thread profiles, multi start threads, left and right hand threads. Square headed and hexagonal nuts and bolts.

Conventional representation of threads. Different types of lock nuts, studs, machine screws, cap screws and wood screws. Foundation bolts.

Different types of joints: Knuckle joint, cotter joint and universal joint.

Text Books/References

1. N.D. Bhatt. Machine Drawing, Charotar Book Stall, Anand.
2. V. Laxminarayan and M.L. Mathur. A Text Book of Machine Drawing, Jain Brothers, New Delhi.
3. P.S. Gill. Machine Drawing, S.K. Kataria & Sons, New Delhi.

ME 124 WORKSHOP TECHNOLOGY

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**3**

Course Outcome: At the end of the course, the student will be able to:

CO1: Understand welding principles, equipment and tools of arc, gas and resistance welding, brazing and soldering.

CO2: Describe construction, operations and tools of lathe, shaper and drilling machines.

CO3: Understand basic hot and cold forming operations.

CO4: Demonstrate knowledge of types of patterns, cores, moulding sands and tools.

CO5: Understand sand, permanent mould and investments castings and casting defects.

Unit-I

Welding: Introduction to types of welding, Principle of Electric arc welding, welding tools and safety devices, welding positions, welding joints, types of welds, Resistance welding, Oxyacetylene gas welding, types of flames, Soldering and Brazing.

Unit-II

Lathes: Constructional details of centre lathe, Main operations and tools used on centre lathes.

Shaper: Types of shapers, Constructional details of standard shaper, shaper tools and main operations.

Unit-III

Drilling Machines: Types of drilling machines, Constructional details of pillar type and radial drilling machines, Main operations, Twist drills, drill angles and sizes.

Forming: Basic descriptions and applications of hot and cold working processes, forging, bending, shearing, drawing and forming operations.

Measurement and Inspections: Classification of measuring instruments, linear & angular measurement, comparators.

Unit-IV

Foundry & Casting Practice: Introduction, types of pattterns, mouldings, moulding Materials, cores, moulding tools and equipments. Moulding sands, properties of moulding sands. Casting defects.

Casting methods: Permanent mould casting, investment casting.

Practicals

Practical exercises on welding, pattern making, foundry and machining operations.

Text Books/References

1. Mathur, Mehta and Tiwari. Elements of Mechanical Engineering, Jain Brothers, New Delhi.
2. S.K. Hajra Choudhury and A.K. Hajra Choudhury. Elements of Workshop Technology (Vol. I and II), Media promoters & Publishers Pvt. Ltd., Bombay.

SECOND YEAR B.TECH. (III SEMESTER)

BS 211 (All Branches) MATHEMATICS – III

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome:

Learning different types of interpolation formulas. Gaining knowledge about various operators, their properties and applications. Getting knowledge of Laplace transform, which is useful for differential equations.

Unit-I

Interpolation: Finite differences, various difference operators and their relationships, factorial notation, Interpolation with equal intervals; Newton's forward and backward interpolation formulae, Lagrange's interpolation formula for unequal intervals.

Unit-II

Gauss forward and backward interpolation formulae, Stirling's and Bessel's central difference interpolation formulae.

Numerical Differentiation: Numerical differentiation based on Newton's forward and backward, Gauss forward and backward interpolation formulae.

Unit-III

Numerical Integration: Numerical integration by Trapezoidal, Simpson's rule.

Numerical Solutions of Ordinary Differential Equations: Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta methods.

Unit-IV

Laplace Transform: Laplace transforms of elementary functions; Basic properties of Laplace transform, Initial value theorem, final value theorem and convolution property of Laplace transform, Inverse Laplace transforms, Applications of Laplace transform to solve ordinary differential equations.

Text Books/References

1. H.C. Saxena. Text Book of Finite Differences and Numerical Analysis, S. Chand and Co.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain. Numerical Methods for Scientific and Engineering computation, New Age International (P) Ltd.
3. N.P. Bali and Manish Goyal. A Text book of Engineering Mathematics, Laxmi Publication Pvt. Ltd., New Delhi (VII Edition).
4. S.P. Goyal and A.K. Goyal. Integral Transforms, Jaipur Publishing House, Jaipur.

AG 213 FUNDAMENTALS OF AGRICULTURE

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Course Outcome:

This course enable the Ag. Engg. Graduates to identify problematic soils and water and also basics of cereal and horticultural crop production.

Unit-I

Soils: Definition of soil, important soil physical properties and their importance, soil inorganic colloids, their composition, properties and origin of charge, ion exchange in soil and nutrient availability, soil organic matter, its composition and decomposition, effect on soil fertility, soil reaction; acid, saline and sodic soils, quality of irrigation water, essential plant nutrients, their functions and deficiency symptoms in plants, important inorganic fertilizers and their mode of action in soils.

Unit-II

Agronomy: Definition and scope of agronomy, classification of crops, effects of different weather parameters on crop growth and development. Soil-water-plant relationship and water requirement of crops, weeds and their control, crop rotation, cropping systems, mono-cropping, double cropping, relay cropping and mixed cropping.

Unit-III

Study of following crops with reference to soil and climate requirements, seedbed preparation, improved varieties, seed rate, time and method of sowing, manuring, fertilisation, intercultural operations, weed control, irrigation, crop protection and their area, production and productivity in Rajasthan: Cereals-wheat, maize and bajra, Pulses- bengal gram, kharif pulses (green gram, black gram, and cowpea), Oil seeds- groundnut and mustard. Introduction to cash crops- cotton, sugarcane and potato and fodder crop- berseem.

Unit-IV

Horticulture: Scope of horticulture and vegetable crops, soil and climatic requirements for fruits, vegetable and floriculture crops, improved varieties, criteria for site selection, layout and planting methods, nursery raising and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices, management of orchards, extraction and storage of vegetable seeds. Introduction to hi-tech horticulture.

Practicals

Soils:

1. Determination of electrical conductivity and pH of soil.
2. Estimation of organic carbon of soil.
3. Determination of bulk density.
4. Determination of particle density and computation of soil porosity.

Agronomy:

1. Identification of crops.
2. Identification of seeds of different crops.
3. Identification of weeds.
4. Fertilizer application methods.
5. Different weed control methods.
6. Judging maturity time for harvesting of kharif crops.

Horticulture:

1. Identification and description of important fruit, flower and vegetable crops.
2. Study of different vegetable cultivation tools.
3. Practices of training and pruning in some important crops.
4. Vegetative propagation methods.

Text Books/references

1. D.K. Das. (2003). Introductory Soil Science, Kalyani Publishers, New Delhi.
2. M.M. Rai. (1995). Principles of Soil Science, S.G. Wasani for Mac Millan India Ltd., New Delhi.
3. K.S. Yawalkar, J.P. Agarwal and S. Bokde. (1992). Manures and Fertilizers. Mrs. Kumudini K. Yawalkar, Agri. Horti. Publishing House, 52, Bajaj Nagar-440 001.
4. Arun Katyayan. (2002). Fundamentals of Agriculture, Kushal Publications and Distributors, A. 3/4A, Trilochan Bazar, Varanasi-221 001 (U.P.).
5. T.Y. Reddy and G.H.S. Reddi. (1992). Principles of Agronomy, Kalyani Publishers, New Delhi.
6. Chattopadhayay. (1999). Text book of Horticulture. Vol. II.
7. J.S. Bal. (1970). Fruit Production. Kalyani Publishers, New Delhi.

CE 211 (CE, AE, EE, MI) STRENGTH OF MATERIAL

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**1**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1: Analyze behavior of materials under simple stress and strains

CO2: Analysis of stress and strains by various methods, stresses in thin cylinder and special shells

CO3: Plot SFD and BMD of beams under various loading and determine shearing and bending stresses

CO4: Analyze various shafts under torque

CO5: Analyze and design columns using different formulae

Unit-I

Fundamentals: Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagrams, mechanical properties of materials, elasticity and plasticity. Shear stress and strain, pure shear, complementary shear. Linear elasticity and Hooke's law. Poison's ratio, volumetric strain, bulk modulus of elasticity. Elastic constants and relation between elastic modulie. Stress and strain in axially loaded members. Temperature stresses and effects.

Unit-II

Analysis of Stress and Strain: Stress at a point, stress components. Stresses on inclined planes. Plane stress and strain. Mohr's circle representation of plain stress and strain. Principle stresses and strains, maximum shear stresses. Hooke's law for plain stress.

Stresses in thin cylinder and special shells subjected to internal & external pressures.

Unit-III

Beam under Flexural Loads : Bending moment and shear force, relation between load, Shear force and bending moment. Bending moment and shear force diagrams for simply supported, Cantilever and overhang beams under static loading of different types viz. point loads, Uniformly distributed loads, linearly varying loads, Pure bending. Theory of simple bending of initially straight beams. Flexural stresses in beams. Built up and composite beams. Shear stresses in beams of Rectangular, Circular and I-section. Shear formula, effect of shear strain.

Unit-IV

Torsion: Torsion of solid and hollow circular shafts. Non-uniform torsion.

Columns: Buckling and stability, critical load. Euler's theory for initially straight column with different end conditions, equivalent length, Limitation of Eulor's formula. Rankine's formula. Column under eccentric loading. Secant, Perry's and Indian standard Formulae.

Practicals

1. Study of Universal Testing Machine, its part and functions.
2. Operation of U.T.M, fixing of specimen for different testing.

3. Tensile test on mild steel specimen to failure and computing, Stresses, % elongation, Contraction etc.
4. Compression test on timber.
5. Compression test on mild steel.
6. Compression test on concrete cube.
7. Determination of toughness test of mild steel, Brass and Aluminum by Charpy test.
8. Determination of toughness by Izod test for wood, Aluminum & Brass.
9. Study of torsion testing machine.
10. Performance of torsion test on circular shaft specimen.
11. Bending test on wooden beam and determination of modulus of rupture.
12. Deflection test on wooden beam.

13-15 Revision.

Suggested Books & References

1. Junarkar S.B. and Shah H.J., 'Mechanics of Structures' Vol.-I Charoter Publishing, Anand.
2. Punima B.C., 'Strength of Materials and Mechanics of Structures', Vol-I, Standard Publisher distributors, New Delhi.
3. Fedinard L., 'Strength of Materials', Singer & Andrew Pytel'.
4. Fenner, 'Mechanics of Solids'.
5. Davis H. E, Trophell, G.E. & Hanck, G.F.W., 'The Testing of Engineering Materials', McGraw Hill.
6. Timoshenko, S.P. & Young, D.H., 'Strength of Materials', East West Press Limited.

CE 212 (AE) FLUID MECHANICS and OPEN CHANNEL HYDRAULICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1: Demonstrate the knowledge of fluid properties.

CO2: Analyze forces and pressure variations on submerged bodies.

CO3: Analyze fluid flow pattern, characteristics and apply the same to solve general flow problems.

CO4: Apply energy equations to determine fluid flow parameters.

CO5: Apply the knowledge to solve problems relating to Open Channel flow.

Unit-I

Hydrostatics: Fluid Properties, Measurement of liquid pressure. Pascal's law fluid pressure on plane and curved stationery surface, Centre of pressure, Principal applications (preliminary) in simple gales and tanks.

Unit-II

Fluid motion: type and patterns, velocity and acceleration of fluid, continuity equation, elementary concept of velocity potential. Stream function and flow nets. Euler's equation of motion, integration of Euler's equation to give Bernoulli's equation for incompressible fluids. Applications of Bernoulli's equation.

Unit-III

Flow through pipes: Various types. Velocity distribution. Loss of head due to friction. Minor losses, hydraulic gradient, pipes in series and parallel.

Discharge measurement in pipes Venturimeter, orificemeter.

Unit-IV

Open Channel Flow: Steady and uniform flow in open channel, Discharge formulae of Chezy, and Manning. Most economic section for rectangular, trapezoidal and circular channels. . Specific energy of flow. Alternate depths. Critical depth in prismatic channels. Discharge measurement *in open channels by notches and weirs*

Practicals

1. Study and use of pressure gauge.
2. Study and use of manometer.

3. Determination of C_C for orifices.
4. Determination of C_d for orifices.
5. Calibration of a Venturimeter.
6. Calibration of V notch.
7. Calibration of Rectangular notch.
8. Determination of friction for pipe.
9. Velocity distribution in channel cross section.
10. Field visit.
11. Revision.

Text Books/References

1. Jadish Lal, Hydraulics. (1986). Metropolitan Book Co. Pvt. Ltd., Delhi.
2. P.N. Modi and S.M. Seth. (1995). Hydraulic and Fluid Mechanics,Standard Book House, Delhi-6.
3. R.K. Bansal. Fluid Mechanics & Machine.

ME 215 (AE) HEAT TRANSFER, REFRIGERATION AND AIR CONDITIONING

	L	T	P
Credit	2	0	1
Hours	2	0	2

Course Outcome: At the end of the course, the student will be able to:

CO1: Apply the principles of conservation of mass, first and second laws of thermodynamics to analyse closed steady state systems and processes involving heat and work interactions.

CO2: Show understanding of concepts of reversibility, entropy and Carnot cycle.

CO3: Demonstrate knowledge of properties of steam and ability to compute them from steam tables and Mollier chart.

CO4: Understand construction and working of steam boilers, steam engines and their specific applications.

CO5: Compute efficiency, power output, etc. of various vapour and gas cycles.

CO6: Demonstrate knowledge about construction and working of IC engines.

Unit I

Introductory concepts, modes of heat transfer, thermal conductivity of different materials, *Conduction:* General differential equation of conduction. One dimensional steady state conduction through plane & composite walls, tubes and spheres without heat generation, critical thickness of insulation. *Convection:* free and forced convection. Newton's law of cooling. Dimensional analysis of free and forced convection.

Unit II

Introduction of Radiation, Absorptivity, reflectivity and transmissivity, Black body and monochromatic radiation, Planck's law, Wien's law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. *Heat Exchangers:* Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger effectiveness, NTU method (Only for parallel and counter flow).

Unit III

Second law of thermodynamics applied to refrigeration. Reversed Carnot cycle, coefficient of performance. Unit of refrigeration, vapour compression cycle and components, Compressors, expansion valves, evaporators and condensers Deviation of actual cycle from ideal cycle, Vapour absorption refrigeration system and components, Desirable properties of ideal refrigerant, Classification of refrigerants.

Unit IV

Psychrometry, Thermodynamic properties of moist air, Psychrometric chart and its use, Elementary Psychrometry processes, bypass and sensible heat factor, Air washer, Design of Air Conditioning system, sensible and latent cooling load calculation.

Practicals

1. Measure thermal conductivity of insulating powders.
2. Study temperature distribution along the length of fin in natural convection.
3. Study temperature distribution along the length of fin in forced convection.

4. Experiment on heat transfer in natural convection.
5. Determine emissivity of given surface.
6. Determine rate of heat transfer, LMTD and overall heat transfer coefficient for parallel flow heat exchanger.
7. Determine rate of heat transfer, LMTD and overall heat transfer coefficient for counter flow heat exchanger.
8. Determine COP of vapour compression refrigeration system.
9. Determine COP of heat pump.
10. Study Electrolux refrigerator.
11. Study of domestic refrigerator and
12. Study of one ton ice plant.
13. Study of water cooler.
14. Study of air conditioner.
15. Study of vapour absorption system.

Texts/References

1. D.S. Kumar: Heat and Mass Transfer, SK Kataria & Sons, Delhi.
2. J. P. Holman: Heat Transfer, McGraw Hill.
3. Y. A. Cengel, Heat teransfer, McGraw-Hill
4. F. P. Incropera and D. P. Dewitt: *Fundamentals of Heat and Mass Transfer*, Wiley.
5. S. Domkundwar: A Course in Heat & Mass Transfer, Dhanpat Rai & Sons, Delhi.
6. C. P. Arora: Refrigeration and Air-conditioning, TMH.
7. W. Stoecker: Refrigeration and Air-conditioning, McGraw Hill.
8. J. L. Threlkeld: Thermal Environmental Engineering, Prentice Hall.
9. Khurmi & Gupta: Refrigeration and Air-conditioning, S. Chand Publishing, New Delhi.

REE 211 FUNDAMENTALS OF RENEWABLE ENERGY SOURCES

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student is exposed to various wastes recycling and renewable energy based efficient technologies. Practical exposure to analyse basic parameters of waste and waste management techniques is also provided.

Unit I

Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES: Solar, Wind, Geothermal, Biomass, Ocean energy sources. Comparison of renewable energy sources with non renewable sources.

Unit II

Solar Energy: Energy available from Sun, Solar radiation data, Solar energy conversion into heat through: Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo voltaic: p-n junctions. Solar cells, PV systems, stand alone, Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics.

Unit III

Wind Energy: Energy available from wind, Lift and drag forces. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors, Determination of torque coefficient, Induction type generators, working principle of wind power plant.

Unit IV

Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages; advantages and disadvantages of biogas spent slurry.

Practical

1. Study of different types of solar cookers.
2. Study of Solar water heating system.
3. Study of Solar photovoltaic system.
4. Study of Natural convection solar dryer
5. Study of Forced convection solar dryer.
6. Study of Solar desalination unit.
7. Study of fixed dome biogas plants.
8. Study of floating drum biogas plants.
9. Study of biomass gasifiers.
10. Study of biomass improved cook-stoves.

Suggested Readings

1. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2. Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.
3. Khandelwal, K.C. & S. S. Mahdi. 1990. Biogas Technology- A Practical Handbook.
4. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Non Conventional Energy Sources, Himanshu Publications.
5. Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.
6. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

SWE 211- WATERSHED HYDROLOGY 2(1+1)

Cr. Hrs. 2 (1 + 1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To give an exposure to the students about the climatic parameters & their analysis to study direct & indirect effect on agriculture scenario of particular area giving main focus on water availability, distribution of circulation.

Unit-I

Hydrologic cycle, precipitation and its forms, rainfall measurement and estimation of mean rainfall, frequency analysis of point rainfall. Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship.

Unit-II

Hydrologic processes-Interception, infiltration . Runoff - Factors affecting, measurement, stage - discharge rating curve, estimation of peak runoff rate and volume, Rational method, Cook's method and SCS curve number method.

Unit-III

Geomorphology of watersheds – Linear, aerial and relief aspects of watersheds- stream order, drainage density and stream frequency. Hydrograph - Components, base flow separation, unit hydrograph theory, S-curve, synthetic hydrograph, applications and limitations.

Unit-IV

Stream gauging - discharge rating curves, flood peak, design flood and computation of probable flood.

Practical

1. Visit to meteorological observatory and study of different instruments.
2. Design of rain gauge network.
3. Exercise on intensity - frequency - duration curves.

4. Exercise on depth - area - duration and double mass curves.
5. Analysis of rainfall data and estimation of mean rainfall by different methods.
6. Exercise on frequency analysis of hydrologic data and estimation of missing data, test for consistency of rainfall records.
7. Exercise on computation of infiltration indices.
8. Computation of peak runoff and runoff volume by Cook's method and rational formula.
9. Computation of runoff volume by SCS curve number method.
10. Study of stream gauging instruments - current meter and stage level recorder.
11. Exercise on geomorphic parameters of watersheds.
12. Exercise on runoff hydrograph.
13. Exercise on unit hydrograph.
14. Exercise on synthetic hydrograph.
15. Exercise on flood routing.

Suggested Readings

1. Chow, V.T., D.R. Maidment and L.W. Mays. 2010. Applied Hydrology, McGraw Hill Publishing Co., New York.
2. Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press, New Delhi.
3. Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1984. Hydrology for Engineers. McGraw-Hill Publishing Co., Japan.
4. Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New Delhi.
5. Raghunath, H.M. 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Limited Publishers, New Delhi.
6. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.
7. Suresh, R. 2005. Watershed Hydrology. Standard Publishers Distributors, Delhi.
8. Varshney, R.S. 1986. Engineering Hydrology. Nem Chand and Brothers, Roorkee, U.P.

SECOND YEAR B.TECH. (IV SEMESTER)

CE 222 (AE) SURVEYING AND LEVELLING

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1: Use Theodolite, Tachometer & Gyroscope.

CO2: Use advanced instruments such as Total station & DGPS.

CO3: Draw & interpret contour maps.

CO4: Perform area volume calculations.

Unit-I

Description, construction and use of Theodolite, Temporary adjustments of Theodolite, Fixing, Centering, leveling and elimination of parallax. Various axes and their relationship. Measurement of Horizontal angle by Repetition and reiteration method. Measurement of vertical angle. Application of theodolite in field problem. Sources of error in the theodolite work.

Unit-II

Principles of Tacheometric survey and its field application. Constants of Tachometer. Staff held vertical and normal. Use of anallactic lens. Calculation of R.L. use of stadia wire.

Application of laser in surveying. Electronic distance measuring equipments. Total Stations and measurements of angles and R.L. calculation. Introduction of DGPS.

Unit-III

Contours, contouring and their characteristics. Methods of contour surveying by Theodolite. Methods of contour surveying by Tachometer. Contour Drawing by different methods.

Unit-IV

Area calculation of regular boundaries by mathematical formulas. Use of Trapezoidal and Simpson's formula, their limitation. Planimeter: Its construction use and theory, Area calculations, Use of zero circle and solution of numerical Problems.

Computation of volumes, Earth work calculations. Level, Two level and Three level sections.

Practicals

1. Conducting contour survey in different area their compilation.
2. Study of theodolite, fixing on stand and temporary adjustment, Permanent adjustment of theodolite and their checking.
3. Horizontal and vertical angle measurements by theodolite.
4. Problems of height and distance.
5. Use of tacheometer with inclined sight and staff held inclined.
6. Contouring by grid method.
7. Contouring by radial line method.
8. Contouring by spot level method.
9. Practice of contour plotting by various methods.
10. Use of planimeter, finding constants and calculation of areas of irregular boundaries.
11. Introduction of total station.
12. Gyroscope and its use

Text Books/References

1. T.P. Kanetker & S.V. Kulkarni. (1990). Surveying and Leveling Vol. I & II Pune Vidyarthi Griha, Prakashan, Pune – 30.
2. B.C. Punmia. (1990). Surveying and Field work Vol. I & II Laxmi Publications, New Delhi.

CE 223 (AE) SOIL MECHANICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1: Find out fundamental properties of soil and their relationship with determining index properties of soil.

CO2: Determine Shear strength of Soil Mass.

CO3: Understand the concept of compaction & consolidation.

CO4: Estimate earth pressure under simple conditions.

Unit-I

Introduction of Soil Mechanics, field of Soil Mechanics. Phase diagram, physical and index properties of soil.

Unit-II

Stress condition in soils, effective and neutral stress.

Shear strength, Mohr-Colomb failure theory. Determination of shear parameters by direct shear, Triaxial and unconfined compression test.

Unit-III

Compaction: Compaction of Soil, standard, modified proctor test and Jodhpur mini compaction test. Field compaction method and control.

Consolidation of soil: One dimensional consolidation, spring analogy, laboratory consolidation test.

Unit-IV

Earth pressure: Plastic equilibrium in soils, active and passive state, Rankine's theory of earth pressure Active and passive earth pressure for cohesive soils, simple numerical exercises.

Bearing capacity: Definition, elementary concept of Rankine's and Terzaghi's analysis. Effect of water table.

Practicals

1. Sieve analysis of soils.
2. Hydrometer analysis for grain size distribution in soils.
3. Field density determination by sand replacement methods.
4. Field density determination by core cutter methods.
5. Determination of maximum dry density and optimum moisture content by :
   (a) Standard.
   (b) Mini compaction.
6. Determination of atterberg's limits of soils.
7. Unconfined compression test.
8. Shear box test.
9. Triaxial test.
10. Consolidation test.
11. Study and use of sampling equipments.

12-15 Field Visit.

Text Books/References

1. Alam Singh. (1990). Soil Engg. Theory & Practice. Asia Publishing House (P) Ltd., New Delhi.
2. B.C. Punmia & A.K. Jain. (1996). Soil Mechanics & Foundations. Laxmi Publication Pvt. Ltd., Ansari road, Darya Ganj. New Delhi- 110002.

ME 223(AE) AUTO CAD APPLICATIONS

	L	T	P
Credit	0	0	2
Hours	0	0	4

Course Outcome: At the end of the course, the student will be able to:

CO1: Describe CAD system components.

CO2: Understand and use various drafting and drawing comands.

CO3 Draw 2-D drawings and use 3 D commands.

CO4: Draw production drawings of simple machine components.

Application of computers for design. CAD- Overview of CAD window – Explanation of various options on drawing screen. Study of draw and dimension tool bar. Practice on draw and dimension tool bar. Study of OSNAP, line thickness and format tool bar. Practice on OSNAP, line thickness and format tool bar. Practice on mirror, offset and array commands. Practice on trim, extend, chamfer and fillet commands. Practice on copy, move, scale and rotate commands. Drawing of 2 D-drawing using draw tool bar. Practice on creating boundary, region, hatch and gradient commands. Practice on Editing polyline- PEDIT and Explode commands. Setting of view ports for sketched drawings. Printing of selected view ports in various paper sizes. 2D- drawing of machine parts with all dimensions and allowances. Foot step bearing and knuckle joint. Sectioning of foot step bearing and stuffing box. Drawing of hexagonal, nut and bolt and other machine parts. Practice on 3-D commands- Extrusion and loft. Practice on 3-D commands-on sweep and press pull. Practice on 3-D Commands- revolving and joining. Demonstration on CNC machine and simple problems.

Practicals:

1. Introduction to CAD LAB-1.
2. Line type, Dimensions and Drafting setting.
3. Use of Draw toolbar.
4. Use of Drawing status bar.
5. Use of Modify toolbar.
6. Uses of Geometric constraints and Dimensional constraints.
7. Practice set using- trim, extend, fillet and chamfer commands.
8. Practice set using- Geometric constraints.

9. Practice set using- Dimensional constraints.
10. Practice set using- explode, boundary.
11. Practice set using- copy, mirror, and move commands.
12. Practice set using- polar array and rectangular array.
13. Practice set using- extrusion and loft.
14. Practice set using- revolving and joining.

Text Books/References

1. Steven Harrington: Computer Graphics- A Programming Approach, McGraw Hill.
2. M. P. Groover and E.W. Zimmers: CAD/CAM- Computer Aided Design and Manufacturing, Prentice-Hall of India, New Delhi
3. Surendra Kumar and A.K. Jha: Technology of Computer Aided Design and Manufacturing CAD/CAM, Dhanpat Rai & Sons, Delhi.

FMP 221 TRACTOR AND AUTOMOTIVE ENGINES

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

The students will be able to learn about different sources of farm power, construction and functioning of CI and SI engines, IC engine fuels, Coolants, anti freeze and anti corrosion materials.

Unit-I

Sources of farm power -conventional and non-conventional energy sources. Classification of tractors and CI engines. Difference between CI and SI, Two stroke and four stroke engines. Status of tractor and power tiller industries in India. Review of thermodynamic principles of CI engines and deviation from ideal cycle. Simple numerical problems horse power calculation.

Unit-II

CI Engine systems: Study of engine components their construction, operating principles and functions.valves & valve mechanism. Fuel, intake and exhaust, ignition, starting and electrical systems.

Unit-III

IC engine fuels : Properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines, Simple numerical problems on fuel combustion.

Unit-IV

Study of properties of coolants, anti freeze and anti-corrosion materials, lubricant types and study of their properties. Engine cooling and lubricating systems. Engine governing systems: centrifugal and pneumatic. Familiarization with the basics of engine testing.

Practical

1. Introduction to different systems of a CI engine; Engine parts and functions.
2. Valve system – study and adjustments.
3. Oil & Fuel - determination of physical properties.
4. Study of Air cleaning system.
5. Study of Fuel supply system of CI engine.
6. Study of Cooling system: thermostat and radiator.
7. Study of Lubricating system.
8. Study of Starting and electrical system of tractor.
9. Study of engine performance curves.
10. Visit to engine manufacturer/ assembler/ spare parts agency.

Text Books \ References

1. Liljedahl, B.J., Turnquist , P.K. Smith, W.D. and Hoki Vaketo1989. Tractor and their Power units. Jhon Wiley & Sons., New York.
2. Jones, F.R., - Farm Gas Engines & Tractors _ Mc.Grow Hill Book Company , New York.
3. Mosses & Frost – Farm Power, John Wiley & Sons, New York.
4. Rai & Jain – Farm Tractor Maintenance and repair, Tata McGraw Hill Publishing Co.Ltd., New-Delhi.
5. Mathur, M.L. and Sharma, R.P. Internal Combustion Engine, Dhanpat Rai & Sons, New Delhi.
6. Gupta, R.B. Automobile Engineering, Satya Prakashan, New Delhi.

CS 226(AE) Web Designing and Internet Applications

Cr. Hrs. 2(1 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

CO1: Understand and implement the basics of Internet.

CO2: Understand and implement the basics of web programming for designing web applications using HTML.

CO3: Understand and implement the basics of web programming for designing web applications using Cascading Style Sheets.

CO4: Understand and implement internet programming and internet use using java script and other common internet applications.

Unit – I

Introduction to Internet: Evolution of Internet, Introduction to Internet Protocol -TCP/IP, UDP, HTTP, Secure Http(SHTTP), Internet Applications – Commerce on the Internet, Governance on the Internet, Impact of Internet on Society – Crime on/through the Internet. Internet Networks: LAN, MAN WAN, Services on Internet (Definition and Functions) E-mail, WWW, Telnet, FTP, IRC and Search Engine.

Unit – II

Mark-up language - HTML: Introduction, Basic Tags, Attributes, Heading, Formatting, Styles, Links, Images, Multimedia, Tables, Lists, Forms, Colors, Layout, Frames, Font, Head, Metatags, Overview of DHTML, Designing web pages using Dreamweaver.

Unit – III

Cascading Style Sheets: Introduction, Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets, Positioning Elements, Backgrounds, Elements Dimensions, Box Model and Text Flow, Media Types, Drop-Down, User Style Sheets, Document Object Model.

Unit – IV

Scripting and recent trends in Internet: Introduction to JavaScript, Decision Making, Control Statements, Functions, Objects, Arrays, Event Handling. Creating Web Banners. Learning to use FTP, Uploading of Site. Introduction to database connectivity, Flas h. Internet Phone, Internet Video, e-commerce, VoIP.

Practicals

1. Write a program to add all basic HTML tags.
2. Write a program to set background image in a frame.
3. Write a program to implement nested lists.
4. Write a program to implement table tag and its various attributes.
5. Write a program to create forms in HTML.
6. Write a program to implement various features of CSS.
7. Write a program to create popup boxes in JavaScript.
8. Write a program to perform arithmetic operations using JavaScript.
9. Write a program to implement in-built string functions in JavaScript.
10. Develop static website using various HTML features including validation of various user details using JavaScript.

Text Books/References

1. Internet for Everyone, Alexis Leon and Mathews Leon, Vikas Publishing House Pvt. Ltd, New Delhi.
2. 'O' Level Module M1.2 Internet & web page designing, VK. Jain, BPB Publication, New Delhi.
3. Web Design The complete Reference, Thomas Powell, Tata Mc Graw Hill.
4. HTML and CSS The complete Reference, Thomas Powell, Tata Mc Graw Hill.
5. JavaScript 2.0 : The Complete Reference, Second Edition by Thomas Powell and Fritz Schneider.

SWE- 221 IRRIGATION ENGINEERING AND SPRINKLER AND MICRO IRRIGATION SYSTEMS

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	**3**	**0**	**1**
Hours	**3**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To train the students and develop basic understanding of soil water plant relationship and select and design appropriate method of water application in varied situations and design of field specific Drip and Sprinkler Irrigation system, their proper operation and the maintenance.

Unit-I

Major and medium irrigation schemes of India, purpose of irrigation, source of irrigation water, present status of development and utilization of different water resources of the country; measurement of irrigation water: weir, flumes and orifices and other methods; open channel water conveyance system: design and lining of irrigation field channels, on farm structures for water conveyance, control & distribution; underground pipe conveyance system: components and design.

Unit-II

soil water plant relationship: soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants, measurement of soil moisture, moisture stress and plant response; water requirement of crops: concept of evapotranspiration (ET), measurement and estimation of ET.

Unit-III

Water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface methods of water application: border, check basin and furrow irrigation- adaptability, specification and design considerations.

Unit-IV

Sprinkler irrigation: adaptability, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps; selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency;

Micro Irrigation Systems: types-drip, spray, & bubbler systems, merits and demerits, different components; Design of drip irrigation system: hydraulics of drip irrigation system, maintenance of micro irrigation system: fertigation: advantages and limitations of fertigation.

Practical

1. Measurement of soil moisture by different soil moisture measuring instruments;
2. Measurement of irrigation water;
3. Measurement of infiltration characteristics; determination of bulk density, field capacity and wilting point;
4. Estimation of evapotranspiration;

5. Design of underground pipeline system;
6. Estimation of irrigation efficiency;
7. Study of advance, recession and computation of infiltration opportunity time; infiltration by inflow-outflow method;
8. Evaluation of border irrigation method;
9. Evaluation of furrow irrigation method;
10. Evaluation of check basin irrigation method.
11. Study of different components of sprinkler irrigation system;
12. Design and installation of sprinkler irrigation system; cost economics of sprinkler irrigation system;
13. Study of different components of drip irrigation;
14. design and installation of drip irrigation system;
15. Field visit to micro irrigation system and evaluation of drip system; cost economics of drip irrigation system.

Suggested Readings

1. Allen R. G., L. S. Pereira, D. Raes, M. Smith. 1998. Crop Evapotranspiration guidelines for computing crop water requirement. Irrigation and drainage Paper 56, FAO of United Nations, Rome.
2. Choudhary M.L and Kadam U.S 2006. Micro irrigation for cash crops Westville Publishing House.
3. Israelsen O W. and Hansen V. E and Stringham G. E. 1980. Irrigation Principles and Practice, John Wiley & Sons, Inc. USA.
4. Keller Jack and Bliesner Ron D. 2001. Sprinkle and Trickle Irrigation. Springer Science+ business Media, New York.
5. Majumdar D. K. 2013. Irrigation Water Management Principles. PHI learning Private Limited New Delhi 2nd Edition.
6. Mane M.S and Ayare B.L. and MagarS.S.2006.Principles of Drip Irrigation systems, Jain Brothers, New Delhi.
7. Mane M.S. and Ayare B.L.2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.
8. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing House New Delhi.
9. Michael AM, Shrimohan and KR Swaminathan. Design and evaluation of irrigation methods, (IARI Monograph No.1). Water Technology Centre, IARI New Delhi.
10. Murthy VVN. 2013. Land and Water Management Engineering. Kalyani Publishers, New Delhi.

SWE – 222 SOIL AND WATER CONSERVATION ENGINEERING 3(2+1)

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

To have understanding about the degradation of productive soil globally and its effect thereon, also to know about the causes about water scarcity and their solution to fight against the evil effects through soil and water conservation technologies.

Unit-I

Soil erosion - Introduction, causes and types - geological and accelerated erosion, agents, factors affecting and effects of erosion. Water erosion - Mechanics and forms - splash, sheet, rill, gully, ravine and stream bank erosion. Gullies - Classification, stages of development.

Unit-II

Soil loss estimation – Universal soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation by KE>25 and EI_{30} methods. Soil erodibility - topography, crop management and conservation practice factors. Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching.

Unit-III

Engineering measures– Bunds and terraces. Bunds - contour and graded bunds - design and surplussing arrangements. Terraces - level and graded broad base terraces, bench terraces - planning, design and layout procedure, contour stonewall and trenching. Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains.

Unit-IV

Grassed waterways and design. Wind erosion- Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures, wind breaks and shelter belts and stabilization of sand dunes. Land capability classification. Rate of sedimentation, silt monitoring and storage loss in tanks.

Practical

1. Study of different types and forms of water erosion.
2. Exercises on computation of rainfall erosivity index.
3. Computation of soil erodibility index in soil loss estimation.
4. Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE.
5. Exercises on soil loss estimation/measuring techniques.
6. Study of rainfall simulator for erosion assessment.
7. Estimation of sediment rate using Coshocton wheel sampler and multi-slot devisor.
8. Determination of sediment concentration through oven dry method.
9. Design and layout of contour bunds.
10. Design and layout of graded bunds.
11. Design and layout of broad base terraces.
12. Design and layout of bench terraces. Design of vegetative waterways.
13. Exercises on rate of sedimentation and storage loss in tanks.
14. Computation of soil loss by wind erosion. Design of shelterbelts and wind breaks for wind erosion control.
15. Visit to soil erosion sites and watershed project areas for studying erosion control and water conservation measures.

Suggested Readings

1. Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
3. Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
4. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
5. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
6. Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaka, New York, USA.
7. Frevert, R.K., G.O. Schwab, T.W. Edminster and K.K. Barnes. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.
8. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

ME 224 (AE) THEORY AND DESIGN OF MACHINES

	L	T	P
Credit	**3**	**0**	**0**
Hours	**3**	**0**	**0**

Course Outcome: At the end of the course, the student will be able to:

CO1: Explain the terminology of kinematics and inversions of common mechanisms.

CO2: Describe characteristics of different types of gears and compute velocity ratio of gear trains.

CO3 Perform calculations required for design of belt & chain drives, flywheel and friction drives.

CO4: Describe characteristics of different types of antifriction bearings.

CO5: Demonstrate knowledge of various considerations involved in the design of machines.

CO6: Determine factor of safety and select appropriate material in view of given conditions.

CO7: Design various mechanical components under static loading.

Unit I

Mechanisms: Elements, links, pairs, kinematic chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions.

Gear: Types of gears. Law of gearing, Involute and cycloidal profile for gear teeth. Spur gear, nomenclature. Interference and undercutting. Introduction to helical, spiral, bevel and worm gear.

Gear Trains: Simple, compound, reverted, and epicyclic trains. Determining velocity ratio by tabular method.

Unit II

Power Transmission: Belt drives, types of drives, belt materials. Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. Effect of centrifugal tension, creep and slip on power transmission. Chain drives. *Flywheel:* Turning moment diagrams, co-efficient of fluctuation of speed and energy, weight of flywheel, flywheel applications. *Friction:* Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, antifriction bearings.

Unit III

Introduction: Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration.

Design of joints: Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear (eccentric loading not included).

Unit IV

Design of shafts, keys and couplings: Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff or sleeve, and rigid flange couplings. Design of flat belt drives.

Design of brackets, levers.

Design of helical and leaf springs.

Text Books/References

1. Joseph E. Shigley and John J. Uicker, Jr.: Theory of Machines and Mechanisms (International Edition), McGraw Hill Inc.
2. R. S. Khurmi and J. K. Gupta: Theory of Machines, S. Chand & Co. Ltd., New Delhi.
3. P. L. Ballaney: Theory of Machines, Khanna Publishers, Delhi.
4. Joseph Edward Shigely: Mechanical Engineering Design, McGraw Hill Book Company, Singapore.
5. P.C. Sharma and D.K. Aggarwal: Machine Design, SK Kataria & Sons, Delhi.
6. R. S. Khurmi and J. K. Gupta: A Text Book of Machine Design, S. Chand & Co. Ltd., New Delhi.

THIRD YEAR B.TECH. (V SEMESTER)

FMP 311 FARM MACHINERY AND EQUIPMENT – I

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To identify the need of farm mechanization in India. Also equip the students with technical knowledge and skills required for the operation, maintenance and evaluation of Tillage, Sowing and intercultural operational machinery needed for agricultural farms. To abreast the students with mathematical, experimental and computational skills for solving different field problems. To develop skills in the students required to develop and modification of indigenous farm machines as per the need of the area and farmers.

Unit-I

Status of farm mechanization, Introduction to various farm operation, implement types. Classification of farm machines. Materials of construction. Tillage and its objectives. Field capacities, field efficiency and simple numerical problems.

Unit-II

Primary and secondary tillage equipment; Ploughs-Disc, Mouldboard, Subsoiler, Rotary tiller, disc harrow and Puddlers. Forces acting on Disc, M.B. Plough and disc harrow. Draft measurement of tillage equipment and simple numerical problems.

Unit-III

Crop planting methods: Sowing and planting equipment - their construction, metering mechanism, furrow openers, covering devices and metering mechanism for fertilizer applications, calibration and adjustments. Paddy transplanter and its construction. Simple numerical problems on seed drills and planters. Introduction to plot seed drills and precision planters.

Unit-IV

Methods and equipments for interculture and weed control. *Introduction to plant protection equipment:* Sprayers, dusters and their calibration, Constructional features of different components and adjustments of knapsack and foot sprayers and rotary duster. Simple numerical problems on calibration of sprayers. Introduction to earth moving equipment, construction & working principles of Bulldozer and numerical problems on its output.

Practicals

1. Introduction to various farm machines and visit to implement's shed.
2. Construction details, adjustments and working of M.B. plough.
3. Construction details, adjustments and working of disc plough.
4. Construction details, adjustments and working of disc harrow.
5. Construction details, adjustments and working of secondary tillage tools.
6. Field capacity and field efficiency measurement of tillage and planting equipment.
7. Draft & fuel consumption measurement of different implements.
8. Working of seed-cum-fertilizer drill and its calibration.
9. Working of planters.
10. Weeding equipments and their use.
11. Study of knapsack and foot sprayers.
12. Study of rotary duster.
13. Construction and working of rotavator.
14. Study of bulldozer.

Text Books\References

1. Bainer, R. Barger, E.L. and R.A. Kepner. (1997). Principles of Farm Machinery. John Wiley & Sons, Inc, New York.
2. A.C. Shrivastava et al. Principle of Farm Machinery ASAE publications.
3. H.P. Smith. (1977). Farm Machinery and Equipment, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi.
4. H Singh and O.S. Bindra. (1980). Pesticides and Application Equipment, Oxford & IBM publishing Co.
5. O.P. Singhal. Elements of Agricultural Engineering, Part I and II. Saroj Prakashan, Allahbad.
6. FAO, Bulletin. (1977). Elements of Agricultural Machinery, volume I.
7. R.L. Peurifoy. Construction, Planning, Equipment and Methods.
8. Singh, S. Principles of Farm Machinery. DIPA, ICAR, KAB-I, New Delhi
9. Singh, Surendra. Farm Machinery Principle and Application. ICAR Publication.
10. Singh, Surendra and S.R. Verma. Farm Machinery Maintenance and Management. ICAR Publication.

CE 313 (AE) BUILDING CONSTRUCTIONS AND COST ESTIMATION

Cr. Hrs. 2 (2 + 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**0**	**0**

Course Outcome: At the end of the course, the student will be able to:

CO1: Demonstrate knowledge of various components of building, Foundations & Masonry constructions.

CO2: Determine concrete properties and demonstrate knowledge of Earthquake management.

CO3: Estimate cost of a simple building & valuations.

CO4: Understand the working organization structure of engineering departments.

(A) BUILDING CONSTRUCTION

Unit-I

Components of a building and their function.

Foundation: Function, shallow and pile foundation. Causes of failure and remedial measures.

Masonry Construction: English bond and Flemish bond for one bricks thick wall.

Stone Masonry: Types of stone masonry, Essentials of good stone masonry.

Unit-II

Concept in Concrete Technology and test on concrete.

Load Carrying Floors: Types, stone patti, timber and R.C.C. floors.

Floor Finishing: Lime, Cement concrete, terrazzo, marble and P.V.C. tiles, details of construction.

Roofs: Simple roof trusses, king post roof truss, queen post roof truss.

Earthquake Disaster Management: Introduction, causes of earthquake, their intensities, its effect, safety measures and precautions to face earthquake problem.

(B) COST ESTIMATION

Unit-III

Object, Main item of works, the unit of measurement for various item of works & materials.

Various methods of building estimate i.e. long wall-short wall methods & centre line method for one & two room building.

Unit-IV

Organization of Engineering Department : General discussion of P.W.D. accounting & procedure of works classification of work. Contract & contact document. Tender Notice- how to invite tender notice. Opening of tender & various conditions to accept it. Running & Final bill, Earnest money, Security money & measurement book.

Valuation : Purpose of valuation, Outgoings, Scrap value, Salvage value, Market value, Book value, annuity capitalized value, Methods of calculating deprecation, Sinking fund deprecation, Valuation of building.

Text Books/References

1. S.P. Arora and Bindra. Building Construction. Dhanpat Rai & Sons, New Delhi
2. S.N. Awaasthy. Building Construction, Publishing House, Bhopal.
3. B.N. Datta. (1994). Estimating & Costing in Civil Engineering, Theory & Practice, Publishing Distributors Ltd., New Dehli.

FMP 312 TRACTOR SYSTEMS AND CONTROLS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

- Gaining knowledge about various tractor systems, their construction and working.
- Learning fundamentals of tractor chassis design and traction theory.

Unit-I

Study of transmission system: Functions of transmission, Clutch:single and multiple clutches and their functions, Gear box: sliding and constant mesh,

differential and final drive mechanism. Simple numerical problems on calculation of speed ratios.

Unit-II

Familiarization of brake mechanism: Mechanical and hydraulic. Steering: Ackerman and hydraulic. Hydraulic system of tractor: Automatic position and draft control.

Unit-III

Tractor power outlets: P.T.O., belt pulley, drawbar. Introduction to traction mechanics. Tractor chassis mechanics: C.G. determination and weight transfer. Simple numerical problems on tractor chassis mechanics.

Unit-IV

Tractor stability: Grade and non-parallel pull, turning at high speed. Simple numerical problems on tractor stability. Introduction to ergonomic considerations: Anthropometry and physiological cost measurements and tractor safety. Introduction to advances in tractor systems and controls.

Practical

1. Study of brake systems: Drum and disc brakes, Mechanical and Hydraulic brakes
2. Introduction to transmission systems and components: study of different types of gear boxes and design problems on gear box.
3. Study on differential and final drive and planetary gears.
4. Study of clutch functioning and parts.
5. Appraisal of various controls in different makes tractors in relation to anthropometric measurements.
6. Determination of location of CG of a tractor.
7. Traction performance of a traction wheel.

Suggested Readings

1. John B. Liljedahl, Paul K Turnquist, David W Smith and Makoto Hoki ‘‘Tradctor and Their Power Units’’ CBS Publisher, 2004.
2. Rodichev V and G Rodicheva, ‘‘Tractor and Automobiles’’ MIR Publication Moscow, 1984.
3. Kirpal Singh, ‘‘Automobile Engineering Vol-I’’ Standard Publisher Distributor, Delhi 13th Edition, 2012.
4. Joseph Heitner, ‘‘Automotive Mechanics: Principles and Practices’’ CBS Publishers 2006.
5. C.B. Richey, ‘‘Agricultural Engineering Handbook’’ McGraw Hill Inc. USA 1961.

PFE 311 POST HARVEST ENGINEERING OF CEREALS, PULSES AND OIL SEEDS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will be able to understand various post-harvest operations of cereals, pulses and oil seeds and their products.

Unit I

Cleaning and grading, aspiration, scalping; size separators, screens, sieve analysis, capacity and effectiveness of screens. Air screen cleaners: specific gravity separator and indented separator.

Unit II

Drying, moisture content and water activity; free, bound and equilibrium moisture content, Psychrometric chart and its use in drying, Drying principles, Thin layer, Falling rate and constant rate drying periods, different methods of drying, mechanical tray dryer and solar dryer.

Unit III

Milling of rice, conditioning and parboiling, advantages and disadvantages, traditional methods and CFTRI parboiling method, modern rice milling, different unit operations in rice milling milling of wheat.

Unit IV

Milling of pulses (traditional and modern milling methods, dry milling and wet milling methods, CFTRI method), Introduction to corn milling (dry and wet milling) and its products. Introduction to oilseeds milling.

Practical

1. Performance evaluation of CIAE grain cleaner.
2. Determination of separation/cleaning efficiency.
3. Study of burr mill and hammer mill.
4. Determination of fineness modulus and uniformity index.
5. Measurement of moisture content: dry basis and wet basis.
6. Study on drying characteristics of grains.
7. Study of mechanical tray dryer and solar dryer.

8. Study of CIAE dhal mill.
9. Study of indented cylinder separator.
10. Study of cylone separator.
11. Visit to grain processing industries.

Suggested Readings

1. Chakraverty, A. Post Harvest Technology of Cereals, Pulses and Oilseeds, Oxford & IBH, publishing Co. Ltd., New Delhi.
2. Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations,Kalyani, Publishers, New Delhi.
3. Sahay, K.M. and Singh, K.K. 1994. Unit Operations of Agricultural Processing,Vikas, Publishing house Pvt. Ltd., New Delhi.
4. Geankoplis C. J. Transport Processes and Unit Operations, Prentice Hall of India Pvt Ltd,New Delhi
5. Earle, R.L. 2003. Unit Operations in Food Processing,Pergamon Press, Oxford. U.K.
6. Henderson, S.M. and Perry, R. L. Agricultural Process Engineering, Chapman and hall,London
7. McCabe, W.L., Smith J.C. and Harriott, P. Unit Operations of Chemical Engineering,McGraw Hill.
8. Singh, R. Paul. And Heldman, R.Dennis. 2004. Introduction to Food Engineering, 3rd Edition, Academic Press, London.

SWE 311 WATERSHED PLANNING AND MANAGEMENT

Cr. Hrs. 2 (1 + 1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To acquaint the students about the preparation of the detail report of the problems and causes related to the water, land, vegetation and social aspects of specific area and their remedies through watershed planning and management.

Unit I

Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.

Unit-II

Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index.

Unit-III

Water budgeting in a watershed. Management measures - rainwater conservation technologies - in-*situ* and *ex-situ* storage, water harvesting and recycling. Dry farming techniques - inter-terrace and inter-bund land management. Integrated watershed management - concept, components.

Unit-IV

Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation. Participatory watershed management - role of watershed associations, user groups and self-help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis.

Practical

1. Exercises on delineation of watersheds using toposheets.
2. Exercises on PRA
3. Surveying and preparation of watershed map.
4. Quantitative analysis of watershed characteristics and parameters.
5. Watershed investigations for planning and development.
6. Analysis of hydrologic data for planning watershed management.
7. Water budgeting of watersheds.
8. Prioritization of watersheds based on sediment yield index.
9. Study of functional requirement of watershed development structures.
10. Study of watershed management technologies.
11. Practice on softwares for analysis of hydrologic parameters of watershed.

12. Study of role of various functionaries in watershed development programmes.
13. Techno-economic viability analysis of watershed projects.
14. Visit to watershed development project areas.

Suggested Readings

1. Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
2. Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
3. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.
4. Sharda, V.N., A.K. Sikka and G.P. Juyal. 2006. Participatory Integrated Watershed Management: A Field Manual. Central Soil and Water Conservation Research and Training Institute, Dehradun.
5. Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner.
6. Singh, P.K. 2000. Watershed Management: Design and Practices. E-media Publications, Udaipur.
7. Singh, R.V. 2000. Watershed Planning and Management. Yash Publishing House, Bikaner.
8. Tideman,E.M. 1999. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi.

SWE 312 GROUNDWATER, WELLS AND PUMPS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To enable the students to know about the ground water potential, its dynamic behaviour and exploration manual and mechanically.

Unit-I

Occurrence and movement of ground water; aquifer and its types; classification of wells, fully penetrating tubewells and open wells, familiarization of various types of bore wells; design of open wells;

Unit-II

Groundwater exploration techniques; methods of drilling of wells: percussion, rotary, reverse rotary; design of tubewell and gravel pack, installation of well screen, completion and development of well; groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's, Theis recovery method;

Unit-III

Well interference, multiple well systems, estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques; pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting.

Unit-IV

Well performance curves, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

Practical

1. Verification of Darcy's Law;
2. Study of different drilling equipments;
3. Sieve analysis for gravel and well screens design;
4. Estimation of specific yield and specific retention;
5. Testing of well screen;
6. Estimation of aquifer parameters by Theis method,
7. Estimation of aquifer parameters by Coopers-Jacob method,
8. Estimation of aquifer parameters by Chow method;
9. Estimation of aquifer parameters by Theis Recovery method;
10. Well design under confined and unconfined conditions; well losses and well efficiency;
11. Estimating ground water balance;
12. Study of artificial ground water recharge structures;
13. Study of radial flow and mixed flow centrifugal pumps, multistage centrifugal pumps, turbine, propeller and other pumps;

14. Installation of centrifugal pump; testing of centrifugal pump and study of cavitations;
15. Study of hydraulic ram; study and testing of submersible pump.

Suggested Readings

1. Michael AM, Khepar SD. and SK Sondhi. 2008. Water Well and Pumps, 2nd Edition, Tata Mc-Graw Hill.
2. Todd David Keith and Larry W. Mays. 2004. Groundwater Hydrology, 3rd Edition, John Wiley & Sons, New York (International Book Distributing Company Lucknow).
3. Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II, 5th Edition. Jain Brothers Publication, New Delhi.

REE 311 RENEWABLE POWER SOURCES

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

The course enables the student to outline the power generation potential from various renewable energy sources and performance evaluation of these devices.

Unit-I

Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. Fundamentals of hydrogen and fuel cell technology.

Unit-II

Biogas technology and mechanisms, generation of power from biogas, Power generation from urban, municipal and industrial waste. Use of different commercial sized biogas plant.

Unit-III

Solar thermal and photovoltaic Systems for power generation. Central receiver (Chimney) and distributed type solar power plant, fundamentals of ocean thermal energy conversion technology, fundamentals of magneto hydro dynamic.

Unit-IV

Wind farms. Aero-generators. Wind power generation system. Power generation from biomass (gasification & Dendro thermal), Mini and micro small hydel plants.

Practical

1. Performance evaluation of solar water heater.
2. Performance evaluation of solar cooker.
3. Characteristics of solar photovoltaic panel.
4. Performance evaluation of solar air heater/dryer.
5. Performance evaluation of biomass gasifier engine system (throatless & downdraft)
6. Performance evaluation of a fixed dome type biogas plant.
7. Performance evaluation of floating drum type biogas plant.
8. Estimation of calorific value of biogas & producer gas.
9. Testing of diesel engine operation using dual fuel and gas alone.

Suggested Readings

1. Garg H.P. 1990. Advances in Solar Energy Technology; D. Publishing Company, Tokyo.
2. Alan L: Farredbruch & R.H. Buse. 1983. Fundamentals of Solar Academic Press, London.
3. Bansal N.K., Kleemann M. & Meliss Michael. 1990. Renewable Energy Sources & Conversion Technology; Tata Mecgrow Publishing Company, New Delhi.
4. Rathore N. S., Kurchania A. K. & N.L. Panwar. 2007. Non Conventional Energy Sources, Himanshu Publications.
5. Mathur, A.N. & N.S. Rathore. 1992. Biogas Production Management & Utilization. Himanshu Publications, Udaipur.
6. Khandelwal, K.C. & S.S. Mahdi. 1990. Biogas Technology.
7. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
8. Mathur A.N. & N.S. Rathore. Renewable Energy Sources Bohra Ganesh Publications, Udaipur.

PFE 312 ENGINEERING PROPERTIES OF AGRICULTURAL PRODUCE

Cr. Hrs. 2 (1 + 1)

	L	T	P
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

Course Outcome:

At the end of the course, the student will learn about different techniques of measurement of engineering properties and their importance in design of processing equipments.

Unit-I

Classification and importance of engineering properties of agricultural produce, physical properties such as shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area of grains, fruits and vegetables.

Unit-II

Thermal properties such as heat capacity, specific heat, thermal conductivity, thermal diffusivity, co-efficient of thermal expansion.

Unit-III

Friction in agricultural materials; static friction, kinetic friction, rolling resistance, angle of internal friction, angle of repose, Flow of bulk granular materials, Aero dynamics of agricultural products, drag coefficients, terminal velocity.

Unit-IV

Rheological properties; force, deformation, stress, strain, elastic, plastic and viscous behavior, Newtonian and Non-Newtonian liquid, Visco-elasticity, Newtonian and Non-Newtonian fluid, Pseudo-plastic, Dilatant, Thixotropic fluids.

Practical

1. Determination of the shape and size of grains, fruits and vegetables.
2. Determination of bulk density and angle of repose of grains.

3. Determination of the particle density/true density and porosity of grains.
4. Finding the co-efficient of external and internal friction of different grains.
5. Determination of specific heat of some food grains.
6. Determination of hardness of food material.
7. Determination of viscosity of liquid foods.

Suggested Readings

1. Mohesin, N.N. 1980. Physical Properties of Plants & Animals, Gordon & Breach Science Publishers, New York.
2. Prentice, J.H. 1984. Measurement in Rheological Properties of Food Stuffs, Elsevier Applied Science Pub, Co. Inc. New York.
3. Rao, M.A. and Rizvi, S.H. 1995. Engineering Properties of Foods. Marcel Dekker Inc. New York.
4. Singhal O. P.and Samuel D. V. K. 2003. Engineering Properties of Biological Materials, Saroj Prakashan, New Delhi
5. Sahay, K.M. and Singh, K.K. 1994. Unit Operations of Agricultural Processing, Vikas, Publishing house Pvt. Ltd., New Delhi.

THIRD YEAR B.TECH. (VI SEMESTER)

FMP 321 FARM MACHINERY AND EQUIPMENT – II

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To identify the need of timely harvesting of crops in India. Also equip the students with technical knowledge and skills required for the operation, maintenance and evaluation of harvesting, threshing and land preparation (heavy) machinery needed for agricultural farms. To abreast the students with mathematical, experimental and computational skills for solving different field problems. To develop skills in the students required to develop and modification of indigenous harvesting machines/methods as per the need of the area and farmers Also to give a brief introductory idea of importance of testing of agricultural machines and tractors.

Unit-I

Principles and types of cutting mechanisms. Harvesting equipment, Mowers – types of mowers (reciprocating and rotary); cutter bar, mowers parts, construction operation and adjustments. Accelerating forces on reciprocating parts and numerical problems. Attachments to the cutter bar, trouble shooting, cutting pattern of reciprocating knife. VCR and its constructional. Simple numerical problems on mowers.

Unit-II

Forage Chopping and Handling: Types of field forage harvesters and choppers, part and construction, details of forage choppers, Attachments, maintenance, trouble shooting. Numerical problems on forage choppers. Introduction of Grain harvesting.

Unit-III

Types and different functional units of combine. Operation, adjustment and different losses. Numerical problems on losses. Introduction to straw combine. Principles of threshing and various types of threshers. Maize harvesting and shelling equipment, Introduction to plot combines and plot threshers.

Unit-IV

Root crop harvesting equipment – potato. Horticultural tools: hand tools and posthole digger. Testing procedure for thresher and combine by using BIS Test codes. Introduction to Laser land leveller.

Practicals

1. Familiarization with various farm machines related to harvesting, threshing and combine.
2. Study of cutterbar: constructional details, adjustments and working.
3. Study of vertical conveyor reaper: constructional details, adjustments and working.
4. Study of potato harvester: constructional details, adjustments and working.
5. Study of forage harvester: constructional details, adjustments and working.
6. Study of maize sheller: constructional details, materials and working.
7. Study of various types of threshers: constructional details, adjustments and working.
8. Study of combine harvester: constructional details, working and trouble shooting.
9. Study of straw combine.
10. Study of laser land leveller.
11. Study of post hole digger.

Text Books\References

1. Bainer, R. Barger, E.L. and R.A. Kepner. (1997). Principle of Farm Machinery. John Wiley & Sons, inc, New York.
2. A.C. Shrivastava. et al. Principle of Farm Machinery, ASAE publications.
3. H.P. Smith. (1977). Farm Power and Equipment, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi
4. FAO, Bulletin. (1977). Elements of Agricultural Machinery, volume II.
5. O.P. Singhal. Elements of Agricultural Engineering, Part I and II. Saroj Prakashan, Allahbad.
6. Singh, S. Principles of Farm Machinery. DIPA, ICAR, KAB -I, New Delhi.
7. Singh, S. and Verma, S.R. Farm Machinery Maintenance and Management. DIPA, ICAR, KAB -I, New Delhi.

PFE 321 FOOD PACKAGING TECHNOLOGY

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will be able to acquaint with various food packaging materials, various aspects of packaging methods and technology.

Unit-I

Factors affecting shelf life of food material during storage, Packaging of foods, requirement, importance and scope, frame work of packaging strategy, environmental considerations, Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging.

Unit-II

Different types of packaging materials, their key properties and applications, metal cans, plastic packaging, different types of polymers used in food packaging and their barrier properties. Manufacture of plastic packaging materials; glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, modification of barrier properties and characteristics of paper/ boards.

Unit-III

Nutritional labeling on packages, CAP and MAP, shrink and cling packaging, vacuum and gas packaging; active packaging, factors affecting the choice of packaging materials, disposal and recycle of packaging waste, printing and labeling; lamination.

Unit-IV

Package testing, testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper, glass containers, metal containers.

Practical

1. Identification of different types of packaging materials.
2. Determination of tensile / compressive strength of given material/package.
3. Vacuum packaging of agricultural produces.
4. Determination of tearing strength of paper board.
5. Measurement of thickness of packaging materials.
6. To perform grease-resistance test in plastic pouches.

7. Determination of bursting strength of packaging material.
8. Determination of water-vapour transmission rate.
9. Shrink wrapping of various horticultural produce.
10. Testing of chemical resistance of packaging materials.
11. Determination of drop test of food package and visit to relevant industries.

Suggested Readings

1. Coles R., McDowell D. and Kirwan, M.J. 2003. Food Packaging Technology, Blackwell Publishing Co.
2. Gosby, N.T. 2001. Food Packaging Materials, Applied Science Publication
3. John, P.J. 2008. A Handbook on Food Packaging, Narendra Publishing House,
4. Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials, Tata McGraw Hill
5. Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide,Narendra Publishing House.
6. Robertson, G. L. 2005. Food Packaging: Principles and Practice, Second Edition, Taylor and
7. Francis Pub.

SWE 321 WATER HARVESTING AND SOIL CONSERVATION STRUCTURES

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

To have understanding about the water scarcity and their solution to fight against the evil effects through soil and water conservation technologies.

Unit-I

Water harvesting -principles, importance and issues. Water harvesting techniques - classification based on source, storage and use. Runoff harvesting – short-term and long-term techniques. Short-term harvesting techniques - terracing and bunding.

Unit-II

Long-term harvesting techniques - purpose and design criteria. Structures - farm ponds - dug-out and embankment reservoir types, tanks and subsurface dykes. Farm pond - components, site selection, design criteria, capacity, embankment, mechanical and emergency spillways, cost estimation and construction. Percolation pond - site selection, design and construction details. Design considerations of *nala* bunds.

Unit-III

Soil erosion control structures - introduction, classification and functional requirements. Permanent structures for soil conservation and gully control - check dams, drop, chute and drop inlet spillways - design requirements, planning for design, design procedures - hydrologic, hydraulic and structural design and stability analysis. Hydraulic jump and its application.

Unit-IV

Drop spillway - applicability, types - straight drop, box-type inlet spillways - description, functional use, advantages and disadvantages, straight apron and stilling basin outlet, structural components and functions. Loads on head wall, variables affecting equivalent fluid pressure, triangular load diagram for various flow conditions, creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension.

Practical

1. Study of different types of farm ponds.
2. Computation of storage capacity of embankment type of farm ponds.
3. Design of dugout farm ponds.
4. Design of percolation pond and *nala* bunds.
5. Runoff measurement using H-flume.
6. Exercise on hydraulic jump.
7. Exercise on energy dissipation in water flow.

8. Hydrologic, hydraulic and structural design of drop spillway and stability analysis.
9. Hydrologic, hydraulic and structural design of drop inlet spillway.
10. Exercise on Strength testing of structures.
11. Design of small earthen embankment structures.
12. Practice on softwares for design of soil and water conservation structures.
13. Field visit to watershed project areas treated with soil and water conservation measures / structures.

Suggested Readings

1. Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
3. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
4. Schwab, G.O., D.D. Fangmeier, W.J. Elliot, R.K. Frevert. 1993. Soil and Water Conservation Engineering.4th Edition, John Wiley and Sons Inc. New York.
5. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
6. Samra, J.S., V.N. Sharda and A.K. Sikka. 2002. Water Harvesting and Recycling: Indian Experiences. CSWCR&TI, Dehradun, Allied Printers, Dehradun.
7. Theib Y. Oweis, Dieter Prinz and Ahmed Y. Hachum. 2012. Rainwater Harvesting for Agriculture in the Dry Areas. CRC Press, Taylor and Francis Group, London.
8. Studer Rima Mekdaschi and Hanspeter Liniger. 2013. Water Harvesting - Guidelines to Good Practice. Centre for Development and Environment, University of Bern, Switzerland.

SWE 322 DRAINAGE ENGINEERING

Cr. Hrs.	**2 (1 + 1)**		
	L	**T**	**P**
Credit	**1**	**0**	**1**
Hours	**1**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To train the students about the reclamation of the agricultural lands suffering from excessive water application and problematic soils

Unit-I

Water logging- causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state; surface drainage coefficient, types of surface drainage, design of surface drains.

Unit-II

Sub-surface drainage: purpose and benefits, investigations of design parameters-hydraulic conductivity, drainable porosity, water table;

Unit-III

Derivation of Hooghoudt's and Ernst's drain spacing equations; design of subsurface drainage system; drainage materials, drainage pipes, drain envelope; layout, construction and installation of drains; drainage structures.

Unit-IV

Vertical drainage; bio-drainage; mole drains; salt balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water.

Practical

1. *In-situ* measurement of hydraulic conductivity by single auger hole.
2. *In-situ* measurement of hydraulic conductivity by inverse auger hole method.
3. Estimation of drainage coefficients.
4. Installation of piezometer and observation wells.
5. Preparation of iso-bath and isobar maps.
6. Determination of drainable porosity.

7. Design of surface drainage systems.
8. Design of gravel envelop.
9. Design of subsurface drainage systems.
10. Determination of chemical properties of soil and water.
11. Study of drainage tiles and pipes.
12. Installation of sub-surface drainage system.
13. Cost analysis of surface drainage system.
14. Cost analysis of sub-surface drainage system.
15. Field visit to water logged area.

Suggested Readings

1. Bhattacharya AK and Michael AM. 2013. Land Drainage, Principles, Methods and Applications. Vikas Publication House, Noida (UP).
2. Ritzema H.P.1994 Drainage Principles and Applications, ILRI Publication 16, Second Edition (Completely Revised).
3. Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II 5th Edition. Jain Brothers Publication, New Delhi.
4. Kadam U.S., Thokal R.T., Gorantiwar S.D. and Powar A.G. 2007. Agricultural Drainage-Principles and Practices, Westville Publishing House.
5. FAO Irrigation and Drainage Paper No. 6, 9, 15, 16, 28 and 38. Rome, Italy.

FMP 322 TRACTORS AND FARM MACHINERY OPERATION AND MAINTENANCE

Cr. Hrs.	**2 (0+ 2)**		
	L	**T**	**P**
Credit	**0**	**0**	**2**
Hours	**0**	**0**	**4**

Course Outcome: At the end of the course, the student will be able to:

Firsthand experience in field operation and adjustments of various agricultural implements and equipments Exposure to small scale farm machinery manufacturing unit.

Practical

1. Familiarization with different makes and models of agricultural tractors. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems.
2. Study of maintenance points to be checked before starting a tractor. Familiarization with controls on a tractor. Safety rules and precautions to be observed while driving a tractor.
3. Driving practice of tractor. Hitching & De-hitching of mounted and trail type implement to the tractor.
4. Practice of operating a tillage tool (mould-board plough/ disc plough) and their adjustment in the field. Study of field patterns while operating a tillage implement.
5. Introduction to tractor maintenance – precautionary and break-down maintenance.
6. Introduction to trouble shooting in tractors. Familiarization with tools for general and special maintenance. Introduction to scheduled maintenance after 10, 100, 300, 600, 900 and 1200 hours of operation.
7. Safety hints. Top end overhauling. Fuel saving tips. Preparing the tractor for storage.
8. Care and maintenance procedure of agricultural machinery during operation and off-season.
9. Replacement of furrow openers and change of blades of rotavators.
10. Maintenance of cutter bar in a reaper.
11. Adjustments in a thresher for different crops. Replacement of V-belts on implements.
12. Setting of agricultural machinery workshop.

Suggested Readings

1. Ghosh RK and S Swan. Practical Agricultural Engineering Vol-I & II, Naya Prakash, 1993.
2. Jain SC and CR Rai. ‘‘Farm Tractor Maintenance and Repair", Standard Publishers and Dist., Delhi, 2010.
3. Operator's manuals of tractors and service manuals provided by manufacturers.

PFE 322 DAIRY AND FOOD ENGINEERING

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will be acquainted with various dairy engineering operations such as homogenization, pasteurization, thermal processing, evaporations, freezing and drying of milk.

Unit-I

Deterioration in food products and their controls, physical, chemical and biological methods of food preservation. Dairy development in India, engineering and chemical properties of milk and milk products.

Unit-II

Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation. Filling and packaging of milk and milk products. Preparation methods and equipment for manufacture of butter.

Unit-III

Principles of operation and equipment for thermal processing, canning, aseptic processing. Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapour recompression.

Unit-IV

Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freeze drying, Filtration: principle, types of filters; Membrane separation, water activity and MSI.

Practical

1. Study of pasteurizers.
2. Study of sterilizers.
3. Study of homogenizers.
4. Study of separators.
5. Study of butter churns.
6. Study of evaporators.

7. Study of milk dryers.
8. Study of freezers.
9. Study of filtration.
10. Visit to multi-product dairy plant, Estimation of steam requirements.
11. Visit to Food industry.

Suggested Readings

1. Ahmed, T. 1997. Dairy Plant Engineering and Management, 4th Ed. Kitab Mahal.
2. McCabe, W.L. and Smith, J. C. 1999. Unit Operations of Chemical Engineering, McGraw Hill.
3. Rao, D.G. Fundamentals of Food Engineering, PHI learning Pvt. Ltd., New Delhi.
4. Singh, R.P. and Heldman, D.R. 1993. Introduction to Food Engineering, Academic Press.
5. Toledo, R. T. 1997. Fundamentals of Food Process Engineering, CBS Publisher.

REE321 BIO-ENERGY SYSTEMS: DESIGN AND APPLICATIONS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

The main objective of this course is to provide fundamentals of utilization of crop residues and agro industrial waste for energy production through different conversion routes and to understanding the biofuels system, renewable feedstock and their production so that following the completion of this course, students will have the expertise to solve agro industrial, social, and environmental problems with appropriate techniques and tools.

UnitI

Fermentation processes and its general requirements. An overview of aerobic and anaerobic fermentation processes and their industrial

application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential.

Unit-II

Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. Harvesting of biomass and coppicing characteristics. Biomass preparation techniques for harnessing (size reduction, densification and drying).

Unit-III

Thermo-chemical degradation. History of small gas producer engine system. Chemistry of gasification. Gas producer – type, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application for shaft power generation, thermal application and economics.

Unit-IV

Trans-esterification for biodiesel production. A range of bio-hydrogen production routes. Environmental aspect of bio-energy, assessment of greenhouse gas mitigation potential.

Practical

1. Study of anaerobic fermentation system for industrial application.
2. Study of gasification for industrial process heat.
3. Study of biodiesel production unit.
4. Study of producer gas burner.
5. Study of biomass densification technique (briquetting, pelletization, and cubing).
6. Integral bio energy system for industrial application.

Suggested Readings

1. British Bio Gen. 1997, Anaerobic digestion of farm and food processing practices- Good practice guidelines, London, available on www.britishbiogen.co.UK.
2. Butler, S. 2005. Renewable Energy Academy: Training wood energy professionals.
3. Centre for biomass energy. 1998. Straw for energy production; Technology- Environment- Ecology. Available: www.ens.dk.

CE 322 (AE) DESIGN OF STRUCTURES

Cr. Hrs. 2 (2 + 0)

	L	T	P
Credit	**2**	**0**	**0**
Hours	**2**	**0**	**0**

Course Outcome: At the end of the course, the student will be able to:

CO1: Analyze Singly and doubly reinforced beams, T- beams

CO2: Understand shear behavior and analyze one way & two way slabs

CO3: Design and analyze of RC Column

CO4: Analyze tension and compression member

(A) REINFORCED CEMENT CONCRETE STRUCTURES

Unit-I

Introduction – Grade of Concrete and Characteristics strength, permissible stress in concrete and steel reinforcement.

Singly Reinforced Beams: Fundamental assumptions, Equivalent area of sections, Neutral axis and Moment of resistance. Balanced, Under-reinforced and Over-reinforced sections.Types of problems in singly reinforced beams.

Doubly Reinforced Beam: Neutral axis, Moment of resistance. Type of problems.

T-Beams: Dimensions, Neutral axis. Lever arm, Moment of resistance with or without web compression.Type of problems in T-Beams.

Unit-II

Shear: Shearstress in R. C. beams, Effect of shear, Reinforcement design for shear. Bond, anchorage, development length.Slabs spanning in one direction.*Two way slabs:* Supported on four edges with corners not held down and carrying U.D.L.

Unit-III

Axially loaded columns: Long and short columns. Types of columns.

Load carrying capacity, I. S. recommendations, Deign of columns with lateral and spiral reinforcement.

(B) *STEEL STRUCTURES*

Unit-IV

*Introduction***:** Types of steels as a structural material, various grades of structural steel, properties and their permissible stresses. Various rolled steel sections and their properties.

Design of tension and compression member.

Note: The use of IS 456:2000, SP16, IS 800:2007 shall be allowed in the examination.

Text Books/References

1. B.C. Punmia. (1992). Reinforced Concrete Structure, Vol.I, Standard Publishers & Distributors, Delhi.
2. Jain and Jaikrishna. (1992). Plane and Reinforced Cement Concrete, Nemi Chand Bros., Roorkee.
3. M.M. Malhotra. (1992). Design of Steel Structure, Jain Brothers, New Delhi.
4. Ram Chandra. (1992). Design of Steel Structures, standard Publishers & Distributors, New Delhi.

FOURTH YEAR B.TECH. (VII SEMESTER)

AE 421 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS MANAGEMENT

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

Understand the concept of entrepreneurship in Indian and global economy; planning and execution of ventures; government report for industry & innovation, contract & joint ventures in horticulture and will be motivated for becoming entrepreneur.

Unit- I

Entrepreneurship, management – Management functions – planning-Organizing -Directing – motivation – ordering – leading – supervision-Communication and control – Capital – Financial management – importance of financial statements – balance sheet – profit and loss statement, Analysis of financial statements – liquidity ratios – leverage ratios, Coverage ratios – turnover ratios – profitability ratios.

Unit - II

Project – project cycle – Project appraisal and evaluation techniques – undiscounted measures – payback period – proceeds per rupee of outlay, Discounted measures – Net Present Value (NPV) – Benefit-Cost Ratio (BCR) – Internal Rate of Return (IRR) – Net benefit investment ratio (N / K ratio) – sensitivity analysis- Importance of agribusiness in Indian economy International trade-WTO agreements – Provisions related to agreements in agricultural and food commodities.

Unit - III

Agreements on agriculture (AOA) – Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS). Development (ED): Concept of entrepreneur and entrepreneurship Assessing overall business environment in Indian economy– Entrepreneurial and managerial characteristics- Entrepreneurship development Programmes (EDP)-Globalization and the emerging business entrepreneurial environment-Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition.

Unit - IV

Role of ED in economic development of a country- Overview of Indian social, political systems and their implications for decision making by

individual entrepreneurs- Economic system and its implications for decision making by individual entrepreneurs- Social responsibility of business. Government schemes and incentives for promotion of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors-, contract farming (CF) and joint ventures (JV), public-private partnerships (PPP)-.

Practical

1. Preparation of business – Strengths Weaknesses Opportunities and Threats (SWOT) analysis,
2. Analysis of financial statements (Balance Sheet, Profit loss statement).
3. Exercise on Compounding and discounting,
4. Study of Break-even analysis with suitable example.
5. Visit to agro-based industries – I in the locality,
6. Visit to agro-based industries – II
7. Study of Agro-industries Development Corporation,
8. Analysis of Ratio – I with suitable examples.
9. Analysis of Ratio – II with suitable examples.
10. Study of application of project appraisal technique – I(Undiscounted measures),
11. Study of application of project appraisal technique–II (Discounted Measures).
12. Formulation of project feasibility reports – Farm Machinery Project proposals as entrepreneur – individual and group –
13. Presentation of project proposals in the class.

Suggested Readings

1. Harsh, S.B., Conner, U.J. and Schwab, G.D. 1981. Management of the Farm Business. Prentice Hall Inc., New Jersey.
2. Joseph, L. Massie. 1995. Essentials of Management. Prentice Hall of India Pvt. Ltd., New Delhi.
3. Omri Rawlins, N. 1980. Introduction to Agribusiness. Prentice Hall Inc., New Jersey
4. Gittenger Price, J. 1989. Economic Analysis of Agricultural Projects. John Hopkins University, Press, London.
5. Thomas W Zimmer and Norman M Scarborough. 1996. Entrepreneurship. Prentice-Hall, New Jersey.
6. Mark J Dollinger. 1999. Entrepreneurship Strategies and Resources. Prentice-Hall, Upper Saddal Rover, New Jersey.
7. Khanka S S. 1999. Entrepreneurial Development. S. Chand and Co. New Delhi.
8. Mohanty S K. 2007. Fundamentals of Entrepreneurship. Prentice Hall India Ltd., New Delhi.

ELECTIVES

PFE 421 Food Quality and Control

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will be able to understand concept of food quality, food safety measurements and various food standards.

Unit I

Basics of food analysis, concept, objectives and need of food quality. Measurement of various properties and their relationship with food quality.

Unit II

Sensory evaluation methods, panel selection methods, interpretation of sensory results. Instrumental method for testing quality, quality control and quality control tools.

Unit III

Food adulteration and food safety. TQM and TQC, Food Safety Management Systems GAP, GHP, GMP and HACCP (Hazard analysis and critical control point), Sanitation in food industry (SSOP).

Unit IV

Dried leafy vegetables viz. spinach, fenugreek, coriander leaves, etc, quality control: Food Laws and Regulations in India, FSSAI, Food grades and standards BIS, AGMARK, ISO 9000, 22000 Series. CAC (Codex Alimantarious Commission), PFA Act, FPO Act, AGMARK,ISO-2000, CAC Codex Alimanterious, commission), BIS.

Practical

1. Examination of cereals & pulses from one of go-downs and market shops in relation to FPO and BIS specifications.
2. Detection of adulteration and examination of ghee for various standards of AGMARK & BIS standards.
3. Detection of adulteration and examination of spices for AGMARK and BIS standards.
4. Detection of adulteration and examination of milk and milk products for BIS standards.

5. Detection of adulteration and examination of fruit products such as jams, jellys, marmalades for FPO specification.
6. Visit to quality control laboratory.
7. Case study of statistical process control in food processing industry.
8. Study of sampling techniques from food processing establishments.
9. Visit to food processing laboratory and study of records and reports maintained by food processing laboratory.

Suggested Readings

1. Sohrab, Integrated ISO 9001 HACCP for Food Processing Industries, Allied Publishers Ltd, Mumbai
2. Krammer, A. and Twigg, B.A. Quality Control for the Food Industry, Volume 2, Applications. The AVI Publishing Company, Westport, Connecticut.
3. Ranganna, S., Hand book of Analysis and Quality Control for Fruits and Vegetable Products, Tata McGraw hill, New Delhi.

PFE 422 FOOD PLANT DESIGN AND MANAGEMENT

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will learn various aspects of design and layout of food plant.

Unit I

Food plant location, selection criteria, Selection of processes, plant capacity, Requirements of plant building and its components, Project design, flow diagrams, selection of equipment, process and controls.

Unit II

Objectives and principles of food plant layout. Salient features of processing plants for cereals, horticultural and vegetable crops, milk and milk products.

Unit III

Entrepreneurship development in food industry, New product development process, Government schemes and incentive for promotion of entrepreneurship.

Unit IV

Govt. policy on small and medium scale food processing enterprise, export and import policies relevant to food processing sector, procedure of obtaining license and registration under FSSAI.

Practical

1. Study of preparation of project report,
4. Study of preparation of feasibility report,
5. Study of layout of pre processing house,
6. Study of layout of Milk and Milk product plants,
7. Development of layout of modern rice mill,
8. Development of layout of Bakery and related product plant,
9. Study of different types of records relating to production of a food plant,
10. Study of different types of records relating to finance of a food plant,
11. Study of different types of records relating to marketing of a food business,

Suggested Reading

2. Hall, H.S. and Rosen, Y.S. (1963) Milk Plant Layout. FAO Publication, Rome.
3. López Antonio. Gómez. Food Plant Design.
4. RobbertsTheunis C.(2013) Food Plant Engineering Systems by CRC Press, Washington.
5. Maroulis Z B and Saravacos G D. (2007) Food Plant Economics. Taylor and Francis, LLC
6. Mahajan M. (2014) Operations Research. Dhanpat Rai and Company Private Limited, Delhi
7. Maroulis Z B. and Saravacos G.D. (2003) Food Process Design. Marcel Dekker, Inc, Cimarron Road, Monticello, New York 12701, USA.

PFE 423 Agricultural Structures and Environmental Control

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will learn various aspects of agricultural structures such as farm stead and dairy barn, environment control.

Unit I

Planning and layout of farmstead, farm fencing, physiological responses of livestock, Environment conducive for the livestock and poultry.

Unit II

Dairy barn design, site selection and layout of dairy barn, and poultry farm design, site selection and lay out of poultry farm.

Unit III

Site selection and orientation of building in regard to sanitation, community sanitation system; sewage system - its design, design of septic tank for small family.

Unit IV

Scope, importance and need for environmental control, renewable and non-renewable resources and their equitable use, concept of eco system, biodiversity of its conservation, environmental pollution and their control, solid waste management system.

Practical

1. Instruments for measurements of environmental parameters.
2. Cooling load of a farm building e.g. poultry house.
3. Design and layout of a dairy farm.
4. Design and layout of a poultry house.
5. Design and layout of a sheep/goat house.
6. Design of a farm fencing system.
7. Design of ventilation system for dairy and poultry house.
8. Design of a feed/fodder storage structures.
9. Familiarization with local grain storage structures.
10. Design of grain storage structures.
11. Cost estimation of a farm building.

Suggested Readings

1. Pandey, P.H. Principles and Practices of Agricultural Structures and Environmental Control, Kalyani Publishers, Ludhiana.
2. Ojha, T.P and Michael, A.M. Principles of Agricultural Engineering. Vol. I, Jain Brothers, Karol Bag, New Delhi.
3. Nathonson, J.A. Basic Environmental Technology, Prentice Hall of India, New Delhi.
4. Venugopal Rao, P. Text Book of Environmental Engineering, Prentice Hall of India, New Delhi.
5. Garg, S.K. Water Supply Engineering, Khanna Publishers, New Delhi-6.
6. Dutta, B.N. Estimating and Costing in Civil Engineering, Duttta & co., Lucknow.
7. Khanna, P.N. Indian Practical Civil Engineer's Hand Book, Engineer's Publishers, New Delhi.
8. Sahay, K.M. and Singh, K.K. Unit Operations of Agricultural Processing, Vikas Publishing pvt. Ltd, Noida.
9. Banerjee, G.C. A Text Book of Animal Husbandry, Oxford IBH Publishing Co, New Delhi.

PFE 424 DEVELOPMENT OF PROCESSED PRODUCTS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will learn various methods and technologies of value addition to various food materials such as rice, oil and spices.

Unit I

Process design, process flow chart with mass and energy balance, unit operations and equipments for processing.

Unit II

New product development, flow chart for value added products from cereal, pulses and oil seeds, milling, puffing, flaking, roasting, bakery products, snack food.

Unit III

Extruded products, flow chart for value added products from fruits, vegetables and spices, canned foods, frozen foods, dried and fried foods, fruit juices, sauce, sugar based confection, candy, fermented food product, spice processing.

Unit IV

Health food, nutra-ceuticals and functional food, milk processing and flow chart for milk product processing.

Practical

1. Process design and process flow chart preparation.
2. Preparation of different value added products.
3. Visit to roller wheat flour milling, rice milling.
4. Visit to spice grinding industry.
5. Visit to milk plant, dal and oil mill.
6. Visit to fruit/vegetable processing plants.
7. Process flow diagram and study of various models of the machines used in a sugar mill.

Suggested Readings

1. Geankoplis C.J. Transport Processes and Unit Operations, Prentice-Hall.
2. Rao, D.G. Fundamentals of Food Engineering, PHI Learning Pvt. Ltd, New Delhi.
3. Norman N. Potter and Joseph H. Hotchikss. Food Science. Chapman and Hall Pub.
4. Acharya, K. T. Everyday Indian Processed Foods. National Book Trust.
5. Mudambi Sumati R., Shalini M. Rao and M V Rajgopal. Food Science. New Age International Publishers.
6. Negi H.P.S., Savita Sharma and K. Sekhon S. Hand book of Cereal Technology, Kalyani Pub., New Delhi

PFE 425 PROCESS EQUIPMENT DESIGN

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will learn various types of material available for fabrications of equipments, different types of heat exchanger and design of shell and tube heat exchanger.

Unit I

Introduction on process equipment design, application of design engineering for processing equipments, design parameters and general design procedure, material specification, types of material for process equipments.

Unit II

Moisture content determination, EMC models principle of drying, theory of diffusion, various drying rate periods falling rate and constant rate period of drying, critical moisture content.

Unit III

Design of cleaners, design of tubular heat exchanger, classification of dryers and operation, heat transfer in grain drying, dryer performance, drying methods.

Unit IV

Scope & importance of material handling devices, design consideration of different types of material handling devices such as belt, chain, screw conveyor, bucket elevator, pneumatic conveying, capacity and power requirement.

Practical

1. Study of cleaners.
2. Study of milling equipments.
3. Study of tubular heat exchanger.
4. EMC models development
5. Design of belt conveyor, bucket elevator, screw conveyor.

6. Material of construction used in equipments.
7. Various methods of moisture content determination.
8. Determination of constant rate drying period.
9. Determination of falling rate drying period.
10. Performance evaluation of dryer.

Suggested Readings

1. Mahajani, V. V. and Umarji, S. B., Process Equipment Design, Macmillan.
2. Geankoplis C.J. (2007) Transport Processes and Unit Operations, Prentice-Hall.
3. Rao, D. G. Fundamentals of Food Engineering, PHI Learning Pvt. Ltd, New Delhi.

PFE 426 POST HARVEST ENGINEERING OF HORTICULTURE CROPS

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

At the end of the course, the student will learn various aspects of post harvest engineering of horticulture crops.

Unit I

Importance of processing of fruits, vegetables and spices, Peeling: different peeling methods; Slicing of fruits and vegetables: equipment for slicing, shredding, crushing, chopping, juice extraction, etc; Blanching: importance and objectives; blanching methods.

Unit II

Application of refrigeration in different perishable food products, chilling requirements of different fruits and vegetables, freezing of food, cold storage heat load calculations and cold storage design; dryers for fruits and vegetables.

Unit III

Common methods of storage, low temperature storage, evaporative cooled storage, controlled atmospheric storage, modified atmospheric packaging.

Unit IV

Preservation technology, general methods of preservation of fruits and vegetables, brief description, advantages and disadvantages of different physical/ chemical and other methods of preservation, flowcharts for preparation of different finished products.

Practical

1. Performance evaluation of peeler.
2. Performance evaluation of slicer.
3. Performance evaluation of juicer.
4. Performance evaluation of pulper.
5. Performance evaluation of blanching equipment.
6. Study of cold storage.
7. Study of CAP and MAP storage.
8. Preparation of value added products.
9. Visit to fruits and vegetables processing industry.
10. Visit to spices processing plant.

Suggested Readings

1. Arthey, D. and Ashurst, P. R. 1966. Fruit Processing, Chapman and Hall, New York.
2. Pantastico, E.C.B. 1975. Postharvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables AVI Pub. Co., New Delhi.
3. Pandey, R.H. 1997. Postharvest Technology of Fruits and Vegetables (Principles and practices). SarojPrakashan, Allahabad.
4. Sudheer, K P. and Indira, V. 2007. Post Harvest Engineering of Horticultural Crops. New india
5. Publishing House.

SWE 421 FLOODS AND CONTROL MEASURES 3(2+1)

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To train the students about the understanding of extent of erosion, losses thereon and stabilization of gullies and ravines and rehabilitation of the affected area and flood control.

Unit-I

Floods - causes of occurrence, flood classification - probable maximum flood, standard project flood, design flood, flood estimation - methods of estimation; estimation of flood peak - rational method, empirical methods, unit hydrograph method.

Unit-II

Statistics in hydrology, flood frequency methods - log normal, Gumbel's extreme value, log-Pearson type-III distribution; depth-area-duration analysis. Flood forecasting. Flood routing - channel routing, Muskingum method, reservoir routing, modified Pul's method. Flood control - history of flood control, structural and non-structural measures of flood control, storage and detention reservoirs, levees, channel improvement. Gully erosion and its control structures - design and implementation.

Unit-III

Ravine control measures. River training works, planning of flood control projects and their economics. Earthen embankments - functions, classification - hydraulic fill and rolled fill dams - homogeneous, zoned and diaphragm type, foundation requirements, grouting, seepage through dams, flow net and its properties, seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes.

Unit-IV

Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc., stability of slopes - analysis of failure by different methods. Subsurface dams - site selection and constructional features. Check dam - Small earthen embankments - types and design criteria. Subsurface dams - site selection and constructional features.

Practical

1. Determination of flood stage-discharge relationship in a watershed.
2. Determination of flood peak-area relationships.
3. Determination of frequency distribution functions for extreme flood values using Gumbel's method.
4. Determination of confidence limits of the flood peak estimates for Gumbel's extreme value distribution.
5. Determination of frequency distribution functions for extreme flood values using log-Pearson Type-III distribution.
6. Determination of probable maximum flood, standard project flood and spillway design flood.
7. Design of levees for flood control. Design of jetties.
8. Study of vegetative and structural measures for gully stabilization.
9. Design of gully/ravine control structures and cost estimation. Designing, planning and cost- benefit analysis of a flood control project.
10. Study of different types, materials and design considerations of earthen dams. Determination of the position of phreatic line in earth dams for various conditions,
11. Stability analysis of earthen dams against head water pressure, foundation shear, sudden draw down condition etc.
12. Stability of slopes of earth dams by friction circle and other methods. Construction of flow net for isotropic and anisotropic media.
13. Computation of seepage by different methods.
14. Determination of settlement of earth dam. Input-output-storage relationships by reservoir routing.
15. Visit to sites of earthen dam and water harvesting structures.

Suggested Readings

1. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
2. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
3. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
4. Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New York, Delhi.

5. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.

6. Bureau of Reclamation. 1987. Design of Small Dams. US Department of Interior, Washington DC, USA.

7. Arora, K.R. 2014. Soil Mechanics and Foundation Engineering (Geotechnical Engineering). Standard Publishers Distributors, Delhi.

8. Garg, S.K. 2014. Soil Mechanics and Foundation Engineering. Khanna Publishers Pvt. Ltd., New Delhi.

9. Stephens Tim. 2010. Manual on Small Earth Dams - A Guide to Siting, Design and Construction. Food and Agriculture Organization of the United Nations, Rome.

SWE 422 WASTELAND DEVELOPMENTS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To train the students about the understanding of ravine rehabilitation, Afforestation - agro-horti-forestry-silvipasture development and land reclamation and rehabilitation.

Unit-I

Land degradation – concept, classification - arid, semiarid, humid and sub-humid regions, denuded range land and marginal lands. Wastelands - factors causing, classification and mapping of wastelands, planning of wastelands development - constraints, agro-climatic conditions, development options, contingency plans.

Unit-II

Conservation structures - gully stabilization, ravine rehabilitation, sand dune stabilization, water harvesting and recycling methods. Afforestation - agro-horti-forestry-silvipasture methods, forage and fuel crops - socioeconomic constraints.

Unit-III

Shifting cultivation, optimal land use options. Wasteland development – hills, semi-arid, coastal areas, water scarce areas, reclamation of waterlogged and salt-affected lands. Mine spoils- impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management.

Unit-IV

Micro-irrigation in wastelands development. Sustainable wasteland development - drought situations, socio-economic perspectives. Government policies. Participatory approach. Preparation of proposal for wasteland development and benefit-cost analysis.

Practical

1. Mapping and classification of wastelands.
2. Identification of factors causing wastelands.
3. Estimation of vegetation density and classification.
4. Planning and design of engineering measures for reclamation of wastelands.
5. Design and estimation of different soil and water conservation structures under arid conditions.
6. Design and estimation of different soil and water conservation structures under semiarid conditions.
7. Design and estimation of different soil and water conservation structures under humid conditions.
8. Planning and design of micro-irrigation in wasteland development.
9. Cost estimation of the above measures / structures.
10. Visit to wasteland development project sites.

Suggested Readings

1. Abrol, I.P., and V.V. Dhruvanarayana. 1998. Technologies for Wasteland Development. ICAR, New Delhi.
2. Ambast, S.K., S.K. Gupta and Gurcharan Singh (Eds.) 2007. Agricultural Land Drainage - Reclamation of Waterlogged Saline Lands. Central Soil Salinity Research Institute, Karnal, Haryana.
3. Hridai Ram Yadav. 2013. Management of Wastelands. Concept Publishing Company. New Delhi.

4. Karthikeyan, C., K. Thangaraja, C. Cinthia Fernandez and K. Chandrakandon. 2009. Dryland Agriculture and Wasteland Management. Atlantic Publishers and Distributors Pvt. Ltd., New Delhi.

5. Rattan Lal and B.A. Stewart (Ed.). 2015. Soil Management of Smallholder Agriculture. Volume 21 of Advances in Soil Science. CRC Press, Taylor and Francis Group, Florida, USA.

6. Robert Malliva and Thomas Missimer. 2012. Arid Lands Water Evaluation and Management. Springer Heidelberg, New York.

7. Swaminathan, M.S. 2010. Science and Integrated Rural Development. Concept Publishing Company (P) Ltd., Delhi.

8. The Energy and Resources Institute. 2003. Looking Back to Think Ahead-Green India 2047. Growth with Resource Enhancement of Environment and Nature. New Delhi.

9. Virmani, S.M. (Ed.). 2010. Degraded and Wastelands of India: Status and Spatial Distribution. ICAR, New Delhi.

SWE 423 REMOTE SENSING AND GIS APPLICATIONS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To train students in use of various hardware and software in use of satellite data, GPS technology in developing GIS based out puts for resource mapping and planning studies.

Unit-I

Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast.

Unit-II

Aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements; photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography.

Unit-III

Satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices; microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data.

Unit-IV

Basic classes of map projections and their properties, Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.

Practical

1. Familiarization with remote sensing and GIS hardware;
2. Use of software for image interpretation;
3. Interpretation of aerial photographs
4. Interpretation of satellite imagery;
5. Basic GIS operations such as image display;
6. Study of various features of GIS software package;
7. Scanning, digitization of maps
8. Data editing;
9. Data base query and map algebra.
10. GIS supported case studies in water resources management.

Suggested Readings

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
6. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.
7. Sahu, K.C. 2008. Text Book of Remote Sensing and Geographic Information Systems. Atlantic Publishers and Distributors (P) Ltd., New Delhi.
8. Shultz, G.A. and E.T. Engman. 2000. Remote Sensing in Hydrology and Water Management. Springer, New York

SWE 424 MANAGEMENT OF CANAL IRRIGATION

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

Students are expose with the technology to design canal irrigation network, crop water requirement and canal water distribution and management.

Unit-I

Purpose benefits and ill effects of irrigation; typical network of canal irrigation system and its different physical components; canal classification based on source of water, financial output, purpose, discharge and alignment; canal alignment: general considerations for alignment; performance indicators for canal irrigation system evaluation.

Unit-II

Estimation of water requirements for canal command areas and determination of canal capacity; water duty and delta, relationship between duty, base period and delta, factors affecting duty and method of improving duty; silt theory: Kennedy's theory, design of channels by Kennedy's theory, Lacey's regime theory and basic regime equations, design of channels by Lacey's theory.

Unit-III

Maintenance of unlined irrigation canals, measurement of discharge in canals, rostering (canal running schedule) and warabandhi, necessity of canal lining: advantages and disadvantages, types of canal lining and desirable characteristics for the suitability of lining materials; design of lined canals.

Unit-IV

Functions of distributary head and cross regulators; canal falls, their necessity and factors affecting canal fall; sources of surplus water in canals and types of canal escapes; requirements of a good canal outlet and types of outlet.

Practical

1. Estimation of water requirement of canal commands;
2. Determination of canal capacity;
3. Layout of canal alignments on topographic maps,
4. Drawing of canal sections in cutting, full banking and partial cutting and partial banking;
5. Determination of longitudinal section of canals;
6. Design of irrigation canals based on silt theories;
7. Design of lined canals;
8. Formulation of warabandhi;
9. Study of canal outlets, regulators, escapes and canal falls.
10. Field visit to canal area.

Suggested Readings

11. Arora, K.R. 2001. Irrigation, Water Power and Water Resources Engineering. Standard Publishers Distributors, Delhi.
12. Garg S. K. 2014. Irrigation Engineering and Hydraulic Structures, Khanna Publishers New Delhi.
13. Sahasrabudhe SR. 2011. Irrigation Engineering and Hydraulic structures. SK Kataria & Sons Reprint 2015.

SWE 425 MINOR IRRIGATION AND COMMAND AREA DEVELOPMENT

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To train the students for design of site specific lift irrigation system as per availability of water and command area on community basis.

Unit-I

Factors affecting performance of irrigation projects; types of minor irrigation systems in India; lift irrigation systems: feasibility.

Unit-II

Type of pumping stations and their site selection, design of lift irrigation systems; tank Irrigation: grouping of tanks, storage capacity, supply works and sluices.

Unit-III

Command area development (CAD) programme- components, need, scope, and development approaches, historical perspective, command area development authorities-functions and responsibilities; on farm development works, reclamation works.

Unit-IV

Use of remote sensing techniques for CAD works; water productivity: concepts and measures for enhancing water productivity; Farmers' participation in command area development.

Practical

1. Preparation of command area development layout plan;
2. Irrigation water requirement of crops;
3. Preparation of irrigation schedules;
4. Planning and layout of water conveyance system;
5. Design of surplus weir of tanks;

6. Determination of storage capacity of tanks;
7. Design of intake pipe and pump house.
8. Field visit to command area.

Suggested Readings

1. Arora, K.R. 2001. Irrigation, Water Power and Water Resources Engineering. Standard Publishers Distributors, Delhi.
2. Garg S. K. 2014. Irrigation Engineering and Hydraulic Structures, Khanna Publishers New Delhi.
3. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Publ.House New Delhi.
4. Sahasrabudhe SR. 2011. Irrigation Engineering and Hydraulic structures. SK Kataria & Sons Reprint 2015.

SWE 426 LANDSCAPE IRRIGATION DESIGN AND MANAGEMENT

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

To train the students about the field specific for design of irrigation system, their proper operation, automation and the maintenance of the system.

Unit-I

Conventional method of landscape irrigation- hose irrigation system, quick release coupling system and portable sprinkler with hose pipes.

Unit-II

Modern methods of landscape irrigation- pop-up sprinklers, spray pop-up sprinkler, shrub adopter, drip irrigation and bubblers; Merits and demerits of conventional and modern irrigation systems, types of landscapes and suitability of different irrigation methods.

Unit-III

Water requirement for different landscapes, Segments of landscape irrigation systems, Main components of modern landscape irrigation systems and their selection criteria; Types of pipes, pressure ratings, sizing and selection criteria.

Unit-IV

Automation system for landscape irrigation- main components, types of controllers and their application, Design of modern landscape irrigation systems, operation and maintenance of landscape irrigation systems.

Practical

1. Study of irrigation equipments for landscapes;
2. Design and installation of irrigation system for landscape,
3. Determination of water requirement.
4. Determination of power requirement, pump selection.
5. Irrigation scheduling of landscapes,
6. Study of irrigation controllers and other equipments,
7. Use of AutoCAD in irrigation design: blocks & symbols, head layout, zoning and valves layout, pipe sizing, Pressure calculations etc.,
8. Visit to landscape irrigation system and its evaluation.

Suggested Readings

1. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Publ. House New Delhi.
2. Singh Neeraj Partap. 2010. Landscape Irrigation and Floriculture Terminology, Bangalore.
3. Smith Stepehen W. Landscape Irrigation and Management. Amazon. com.

SWE 427 PLASTIC APPLICATIONS IN AGRICULTURE

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

Students are expose with the technology to design micro irrigation fertigation system greenhouse design, environment control for efficient management of crop to increase productivity.

Unit-I

Introduction of plasticulture - types and quality of plastics used in soil and water conservation, production agriculture and post harvest management. Quality control measures. Present status and future prospective of plasticulture in India. Water management - use of plastics in in-situ moisture conservation and rain water harvesting.

Unit-II

Plastic film lining in canal, pond and reservoir. Plastic pipes for irrigation water management, bore-well casing and subsurface drainage. Drip and sprinkler irrigation systems. Use of polymers in control of percolation losses in fields. Soil conditioning - soil solarisation, effects of different colour plastic mulching in surface covered cultivation.

Unit-III

Nursery management - Use of plastics in nursery raising, nursery bags, trays etc. Controlled environmental cultivation - plastics as cladding material, green / poly / shade net houses, wind breaks, poly tunnels and crop covers. Plastic nets for crop protection - anti insect nets, bird protection nets. Plastic fencing. Plastics in drying, preservation, handling and storage of agricultural produce, innovative plastic packaging solutions for processed food products. Plastic cap covers for storage of food grains in open. Use of plastics as alternate material for manufacturing farm equipment and machinery.

Unit-IV

Plastics for aquacultural engineering and animal husbandry - animal shelters, vermi-beds and inland fisheries. Silage film technique for fodder preservation. Agencies involved in the promotion of plasticulture in agriculture at national and state level. Human resource development in plasticutlure applications.

Practical

1. Design, estimation and laying of plastic films in lining of canal, reservoir and water harvesting ponds.
2. Study of plastic components of drip and sprinkler irrigation systems, laying and flushing of laterals.
3. Study of components of subsurface drainage system.
4. Study of different colour plastic mulch laying.
5. Design, estimation and installation of green, poly and shade net houses, low tunnels etc.
6. Study on cap covers for food grain storage, innovative packaging solutions - leno bags, crates, bins, boxes, vacuum packing, unit packaging, CAS and MAP and estimation.
7. Study on use of plastics in nursery, plant protection, inland fisheries, animal shelters, preparation of vermi-bed and silage film for fodder preservation.
8. Study of plastic parts in making farm machinery.
9. Visits to nearby manufacturing units/dealers of PVC pipes, drip and sprinkler irrigation systems, greenhouse/ polyhouse/shadehouse/ nethouse etc.
10. Visits to farmers' fields with these installations.

Suggested Readings

1. Brahma Singh, Balraj Singh, Naved Sabir and Murtaza Hasan. 2014. Advances in Protected Cultivation. New India Publishing Agency, New Delhi.
2. Brown, R.P. 2004. Polymers in Agriculture and Horticulture. RAPRA Review Reports : Vol. 15, No. 2, RAPRA Technology Limited, U.K.
3. Central Pollution Control Board. 2012. Material on Plastic Waste Management. Parivesh Bhawan, East Arjun Nagar, Delhi-110032.
4. Charles A. Harper. 2006. Handbook of Plastics Technologies. The Complete Guide to Properties and Performance. McGraw-Hill, New Delhi.
5. Dubois. 1978. Plastics in Agriculture. Applied Science Publishers Limited, Essex, England.
6. Manas Chanda, Salil K. Roy. 2008. Plastics Fundamentals, Properties, and Testing. CRC Press.

7. Ojha,T.P. and Michael, A.M., 2012, Principles of Agricultural Engineering - I. Jain Brothers, Karol Bagh, New Delhi.
8. Pandey, P.H. 2014. Principles and Practices of Agricultural Structures and Environmental Control. Kalyani Publishers, Ludhiana, India.
9. Shankar, A.N. 2014. Integrated Horticulture Development in Eastern Himalayas, Plasticulture in Agri-Horticulture Systems, 241-247.
10. Srivastava, R.K., R.C. Maheswari, T.P. Ojha, and A. Alam. 1988. Plastics in Agriculture. Jain Brothers, Karol Bagh, New Delhi.

FMP 421 MECHANICS OF TILLAGE AND TRACTION

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

Know Mechanics of soil cutting, Traction force, torque-slip relationship and traction aid for tractor and other traction machineries.

Unit-I

Introduction to mechanics of tillage tools, engineering properties of soil, design of tillage tools principles of soil cutting, design equation.

Unit-II

Introduction to traction mechanics, Measurement and characterization of terrain behaviour: stress-strain relationship, pressure sinkage relationship and cone penetrometer.

Unit-III

Motion resistance of a rigid and pneumatic wheel, Mechanics of towed, self propelled and driving wheel; Wheel slip, its measurement; Criteria of performance of traction devices.

Unit-IV

Traction prediction approach: Mobility number & effect of mobility number on tractive effort, traction improvement, tyre construction: bias and radial, tyre testing, soil compaction.

Practicals

1. Measurement of static and dynamic soil parameters related to tillage.
2. Measurement of slip and sinkage under dry and wet soil conditions.
3. Measurement of load and fuel consumption for different farm operations.
4. Studies on tyres under different conditions.
5. Studies on compaction and number of operations.

Text Books/References

1. W.R. Gill and Vanden Berg. (1968). Soil Dynamics in Tillage, Handbook No. 316, US Department of Agriculture, USA.
2. M.G. Bekker. (1956). Theory of land Locomotion, University of Michigan Press, USA.
3. M.G. Bekker. (1969). Off-Road Locomotion, University of Michigan Press USA.
4. M.G. Bekker. (1969). Introduction of Terrain Vehicle System, Michigan, USA.
5. J.Y. Wong. (1978). Theory of Ground Vehicle, John Willey & Sons, New York.

FMP 422 FARM MACHINERY DESIGN AND PRODUCTION

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

The student will able to design standard power transmission components used in agricultural machines. The student will also have the knowledge of various heat treatment methods and industrial layout planning along with quality production management.

Unit I

Introduction to design parameters of agricultural machines & design procedure. Characteristics of farm machinery design. Research and development aspects of farm machinery. Design of standard power transmission components used in agricultural machines: mechanical & hydraulic units.

Unit II

Introduction to safety in power transmission. Application of design principles to the systems of selected farm machines. Critical appraisal in production of Agricultural Machinery; Advances in material used for agricultural machinery.

Unit III

Advanced manufacturing techniques including powder metallurgy, EDM (Electro-Discharge Machining), Heat Treatment of steels including pack carburizing, shot pining process, etc.

Unit IV

Limits, Fits & Tolerances, Jigs & Fixtures. Industrial lay-out planning, Quality production management. Reliability. Economics of process selection. Familiarization with Project Report.

Practical

1. Familiarization with different design aspects of farm machinery and selected components.
2. Solving design problems on farm machines & equipment
3. Visit to Agricultural machinery manufacturing industry,
4. Tractor manufacturing industry
5. Jigs and Fixtures – study in relation to agricultural machinery. Fits, tolerances and limits
6. Layout planning of a small scale industry
7. Problems on Economics of process selection; Preparation of a project report;
8. Case study for manufacturing of simple agricultural machinery.

Suggested Readings

1. Richey, C.B. ‘‘Agricultural Engineering Handbook", McGraw Hill Inc. USA, 1961.
2. Adithan M. and A.B. Gupta, ‘‘Manufacturing Technology" Ist Edition (Reprint 2012), New Age International (P) Ltd.)
3. Sharma P.C. and D.K. Agrawal, ‘‘Machine Desigh’’, S.K. Kataria & Sons, 1997.
4. Narula V., ‘‘Manufacturing Processes’’, S.K. Kataria & Sons, 2010.
5. Singh S. Mechanical Engineer’s Handbook, S. Chand Publisher, 2011.
6. Chakrabarti N.R. Data book for Machine Design, Khanna Publisher, 1984.

FMP 423 TRACTOR DESIGN AND TESTING

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

Design parameters of tractor engine components and power transmission system. Stability during operation and different tests conducted on tractor.

Unit-I

Introduction to development of agricultural tractor. Study of parameters for balanced design of tractor for stability, weight distribution and hitch system.

Unit-II

Design of various engine components: piston, cylinder and cylinder liner, connecting rod, crankshaft and valve.

Unit-III

Design of mechanical power transmission in agricultural tractors. Design of Ackerman Steering. Introduction of computer application to design of engine components, differential, final drive and axle power takeoff shaft.

Unit-IV

Design of seat and controls of an agricultural tractor. Tractor Testing as per BIS codes.

Practicals

1. Design problem of tractor clutch.
2. Design problem on spur gears.
3. Design problem of bevel gears.
4. Design problem of helical gears.
5. Design of gear box (synchromesh/constant mesh).
6. Selection of tractor tires – Problem solving.
7. Problem on design of governer.
8. Engine testing as per BIS code – various tests; Drawbar performance in the lab; PTO test and measure the tractor power in the lab/field.
9. Visit to tractor testing centre/industry.

Text Books/References

1. A. Kolchin and V. Dominov. (1984). Design of Automotive Engines. Mir Publications, Moscow.
2. B.J. Liljedahl, P.K. Turnquist, W.D. Singh and Hoki, Makato. (1989). Tractor and there Power Units, Fourth Edition, Avi Publication, New York.
3. C.V. Litchy. (1951). Internal Combustion Engines, McGraw Hill Pub., New York.
4. V.L. Maleev. (1951). Internal Combustion Engines, McGraw Hill Pub., New York.

FMP 424 HYDRAULIC DRIVES AND CONTROLS

Cr. Hrs.	**3 (2 + 1)**		
	L	**T**	**P**
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome: At the end of the course, the student will be able to:

Basic knowledge of hydraulic system of tractor its operation and maintenance Detailed information of different components of hydraulic system and construction of hydraulic circuits. Selection criteria of different hydraulic components. Common calculations for load and capacity of the system components.

Unit I

Principles of Hydraulics: Hydraulic Basics: Pascal's Law, Flow, Energy, Work, and Power. Working of Hydraulic Systems, Open centre and close centre hydraulic systems, Reservoirs, Strainers and Filters, Filtering Material. Types of hydraulic Fluid and their properties.

Unit II

Pumps: Pump Classifications, selection, Performance, Displacement, Gear Pumps, Vane Pumps, Piston Pumps, Pump Operation. Hydraulic Actuators: Cylinders-displacement, Construction and Applications, Semi rotary actuators. Simple numerical problems on pumps.

Unit III

Hydraulic Motors. Accumulators: Types and working. Fittings and Connectors. Hydraulic valves: Pressure-Control Valves, Directional-Control Valves, Flow-Control Valves, Valve Failures and Remedies, Valve Assembly.

Unit IV

Hydraulic Troubleshooting. Tractor hydraulics, nudging system, ADDC. Use of Hydraulics and Pneumatics drives in agricultural systems. Maintenance of hydraulic system.

Practical

1. Introduction to Hydraulic Systems.
2. Study of Hydraulic Pumps.
3. Study of Hydraulic Actuators.
4. Study of Hydraulic Motors.
5. Study of Hydraulic Valves.
6. Maintenance of hydraulic system.
7. Hydraulics in Tractors.
8. Pneumatics in Agriculture.

Text Books/References

1. Lilijedahl, B.J., Turanquist, P.K. Smith W.D. and Hok: Makoto, 1989. Tractors and their power unity. AG publication, fourth edition, New York.
2. Michael, J.P. and John., G.A. 1989. Power Hydraulics, Prenlice Hall, New York.
3. Fundamentals of service 'FOS', Hydraulics, John deere and company, Moline.
4. Singh Kirpal, Automobile Engineering Part I, Standard Publishing Distributors, Delhi.

FMP 425 PRECISION AGRICULTURE AND SYSTEM MANAGEMENT

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

The Student will get familiarize with different equipment for precision agriculture. The student will be able to know use of GIS for precision agriculture along with application to PERT and CPM for machinery system management.

Unit I

Precision Agriculture – need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with equipment for precision agriculture including sowing and planting machines, power sprayers and land clearing machines.

Unit II

Familiarization with equipment for precision agriculture including laser guided land levellers, straw-chopper, straw-balers, grain combines, etc.

Unit III

Introduction to GIS based precision agriculture and its applications. Introduction to sensors and application of sensors for data generation. Database management.

Unit IV

System concept. System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations. Application to PERT and CPM for machinery system management.

Practical

1. Familiarization with precision agriculture problems and issues.
2. Familiarization with various machines for resource conservation.
3. Solving problems related to various capacities, pattern efficiency, system limitation, etc.
4. Problems related to cost analysis and inflation and problems related to selection of equipment, replacement, break-even analysis, time value of money etc.

Suggested Readings

1. Kuhar John. E. 1977. ‘‘The Precision Farming Guide for Agriculturist’’. Lori J. Dhabalt, USA.
2. Dutta S.K. 1987. ‘‘Soil Conservation and land management’’, International distributors, Dehradun.
3. Sigma and Jagmohan. 1976. ‘‘Earth Moving Machinery’’, Oxford & IBH.
4. De Mess M.N. ‘‘Fundamentals of Geographic Information System’’, John Willy and Sons, New York.
5. Hunt D. 1977. ‘‘Farm Power and Machinery Management’’, Iowa State University Press.
6. Sharma D.N. and S. Mukesh, 2013. ‘‘Farm Power and Machinery Management, Vol Ist, Jain Brothers.
7. Stuart Wood, 1977. ‘‘Heavy Construction Equipment and Method’’, Prentice Hall.

FMP 426 HUMAN ENGINEERING AND SAFETY

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

The student will have knowledge of various human factors in system development, importance of anthropometry in utilization of work space, heat exchange process and performance and safety gadgets for different farm operations.

Unit I

Human factors in system development – concept of systems; basic processes in system development, performance reliability, human performance. Information input process, visual displays, major types and use of displays, auditory and factual displays.

Unit II

Speech communications, Biomechanics of motion, types of movements, Range of movements, strength and endurance, speed and accuracy, human control of systems.

Unit III

Human motor activities, controls, tools and related devices. Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution.

Unit IV

Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

Practical

1. Calibration of the subject in the laboratory using bi-cycle ergo-meter.
2. Study and calibration of the subject in the laboratory using mechanical treadmill.
3. Use of respiration gas meter from human energy point of view.
4. Use of Heart Rate Monitor.
5. Familiarization with anthropometric measurements of a selected subjects.
6. Optimum work space layout and locations of controls for different tractors.
7. Familiarization with the noise and vibration equipment.
8. Familiarization with safety gadgets for various farm machines.

Suggested Readings

1. Chapanis A. 1996. Human Factors in System Engineering. John Wiley & Sons, New York.
2. Dul J. and Weerdmeester B.1993. Ergonomics for Beginners. A Quick Reference Guide. Taylor and Francis, London.
3. Mathews J. and Knight A. A. 1971. Ergonomics in Agricultural Equipment Design. National Institute of Agricultural Engineering.
4. Astrand P. And and Rodahl K. 1977. Textbook of Work Physiology. Mc Hill Corporation, New York.
5. Mark S. Sanders and Ernest James McCormick. 1993. Human Factors in Engineering and Design. Mc Hill Corporation, New York.
6. Keegan J J, Radke AO. 1964. Designing vehicle seats for greater comfort. SAE Journal;72:50~5.
7. Yadav R, Tewari V.K. 1998. Tractor operator workplace design-a review. Journal of Terra mechanics 35: 41-53.

FMP 427 PRECISION FARMING TECHNIQUES FOR PROTECTED CULTIVATION

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

The student will gain knowledge of need, design and construction of Greenhouse. The student will be able to demonstrate the abilities to operate greenhouse by having the knowledge of root media, instrumentation, fertilization, and other operating parameters.

Unit I

Protected cultivation: Introduction, History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polyhouses /shed nets, Plant environment interactions – principles of limiting factors, solar radiation and transpiration, greenhouse effect, light, temperature, relative humidity, carbon dioxide enrichment.

Unit II

Design and construction of green houses – site selection, orientation, design, construction, design for ventilation requirement using exhaust fan system, selection of equipment, Greenhouse cooling system – necessity, methods – ventilation with roof and side ventilators, evaporative cooling, different shading material fogging, combined fogging and fan-pad cooling system, maintenance of cooling and ventilation systems, pad care etc. Greenhouse heating – necessity, components, methods.

Unit III

Root media – types – soil and soil less media, composition, estimation, preparation and disinfection, bed preparation. Planting techniques in green house cultivation. Irrigation in greenhouse and net house – Water quality, types of irrigation system, components, installation and material requirement. Fogging system for greenhouses and net houses – introduction, benefits, design, installation and material requirement. Maintenance of irrigation and fogging systems.

Unit IV

Fertilization – nutrient deficiency symptoms and functions of essential nutrient elements, principles of selection of proper application of fertilizers, fertilizer scheduling, rate of application of fertilizers, methods, automated fertilizer application. Greenhouse climate measurement, control and management. Insect and disease management in greenhouse and net houses Selection of crops for greenhouse cultivation, major crops in greenhouse – irrigation requirement, fertilizer management, cultivation, harvesting and post harvest techniques; Economic analysis.

Practical

1. Estimation of material requirement for construction of greenhouse.
2. Estimation of material requirement for preparation of root media; Root media preparation, bed preparation and disinfections.
3. Study of different planting techniques.
4. Design and installation of irrigation system.
5. Study of different greenhouse environment control instruments.
6. Study of operation maintenance and fault detection in irrigation system.
7. Economic analysis of greenhouses and net houses.
8. Visit to greenhouses.

Suggested Readings

1. Salokhe V.M. and Ajay Kumar Sharma 2006. Greenhouse: Technology and applications. Agrotech Publishing Academy, Udaipur (Raj) ISBN No. 81-8321-057-0
2. Singh Brahma and Balraj Singh. 2014. Advances in protected cultivation, New India Publishing Company.
3. Sharma P. 2007. Precision Farming. Daya Publishing House New Delhi.

REE 421 PHOTOVOLTAIC TECHNOLOGY AND SYSTEMS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

The course is designed to generate awareness on fundamentals of solar pv systems and basic know how about pv technology and power generation.

Unit I

Solar PV Technology: Advantages, Limitations, Current Status of PV technology, SWOT analysis of PV technology. Types of Solar Cell, Wafer based Silicon Cell, Thin film amorphous silicon cell Thin Cadmium Telluride (CdTe) Cell, Copper Indium Gallium Selenide (CiGS) Cell, Thin film crystalline silicon solar cell.

Unit II

Solar Photo Voltaic Module: Solar cell, solar module, solar array, series & parallel connections of cell, mismatch in cell, fill factor, effect of solar radiation and temperature on power output of module, I-V and power curve of module.

Unit III

Balance of Solar PV system: Introduction to batteries, battery classification, lead acid battery, Nicked Cadmium battery, comparison of batteries, battery parameters, Charge controller: types of charge controller, function of charge controller, PWM type, MPPT type charge controller.

Unit IV

Converters: DC to DC converter and DC to AC type converter. Application of Solar PV system. Solar home lighting system, solar lantern, solar fencing, solar street light, solar water pumping system, Roof top solar photovoltaic power plant and smart grid.

Practical

1. To study of V-I characteristics of solar PV system
2. To demonstrate the I-V and p-V characteristics of PV module with varying tradition and temperature level
3. To demonstrate the I-V and p-V characteristics of series and parallel combinations of PV Module
4. To show the effect of variation in tilt angle on PV module power
5. To study smart grid technology and application.
6. To study manufacturing technique of solar array, different DC to DC and DC to AC converter.
7. To study domestic solar lighting system.
8. To study various solar module technologies.

Suggested Readings

1. Rai GD. 1998. Non-conventional Sources of Energy. Khanna Pub.
2. Rathore N.S., Kurchania A.K., Panwar N.L. 2006. Renewable Energy: Theory & Practice, Himanshu Publications,.
3. Solanki C.S. 2011. Solar Photovoltaic: Fundamentals, Technologies and Applications, PHI Learning Private Ltd.
4. Meinel & Meinel. Applied Solar Energy.
5. Derrick, Francis and Bokalders, Solar Photo-voltaic Products.

REE 422 WASTE AND BY-PRODUCTS UTILIZATION

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	**2**	**0**	**1**
Hours	**2**	**0**	**2**

Course Outcome:

The course is designed to generate awareness on recycling and energy recovery from different wastes and by-products from households, municipal or industrial sectors. It is useful in creating confidence on reduced dependence of fossil fuel based economy.

Unit I

Types and formation of by-products and waste; Magnitude of waste generation in different food processing industries; Environmental performance of food industry to comply with ISO-14001 standards. Waste utilization in various industries, furnaces and boilers run on agricultural wastes and by-products. Biological and chemical oxygen demand from different food plant waste, other chemical impurities in industrial wastes like metallic ion, additives, and microbial load, etc.

Unit II

Waste water management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste water, other ingredients like insecticide, pesticides and fungicides residues in waste water.

Pre-treatment of Waste Water: Single dwelling unit, a septic tank, Primary treatment: sedimentation, coagulation, flocculation and floatation, Secondary treatments:– trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons, Advanced treatment process. Final Treatment Solid processing

Unit III

Concept, scope and maintenance of Solid Waste treatment and disposal, Assessment, treatment and MSW management Land filling. Effluent treatment plants in Industries.

Unit IV

Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill, etc.

Bioconversion Technology: Organic manure, Vermi-composting, Biogas generation: design, construction, operation and management of institutional community and family size biogas plants, Biogas utilization briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization.

Practical

1. Determination of temperature, pH, total Solid in waste water.
2. BOD and COD analysis of waste water.

3. Determination of ash content of agricultural wastes and determination of un-burnt carbon in ash.
4. Study about briquetting of agricultural residues.
5. Estimation of excess air for better combustion of briquettes.
6. Study of extraction of oil from rice bran.
7. Study on bioconversion of agricultural wastes.
8. Visit to various industries using waste and food by-products.

Suggested Readings

1. Markel, I.A. 1981. Managing Livestock Waste, AVI Publishing Co.
2. Pantastico, ECB. 1975. Post Harvest Physiology, Handling and utilization of Tropical and Sub-tropical fruits and vegetables, AVI Pub. Co.
3. Shewfelt, R.L. and Prussi, S.E. 1992. Post-Harvest Handling – A Systems approach, Academic Press Inc.
4. USDA. 1992. Agricultural Waste Management Field Hand book. USDA, Washington DC.
5. Weichmann J. 1987. Post Harvest Physiology of vegetables, Marcel and Dekker Verlag.
6. V.K. Joshi & S.K. Sharma. Food Processing Waste Management: Treatment & Utilization. New India Publishing Agency.
7. Vasso Oreopoulou and Winfried Russ (Edited). 2007. Utilization of By-products and Treatment of waste in the Food Industry. Springer Science & Business media, LLC 233 New York.
8. Prashar, Anupama and Bansal, Pratibha. 2007-08. Industrial Safety and Environment. S.K. Kataria and sons, New Delhi
9. Garg, S K. 1998. Environmental Engineering (Vol. II) – Sewage Disposal and Air Pollution Engineering. Khanna Publishers, New Delhi
10. Bhatia, S.C. 2001. Environmental Pollution and Control in Chemical Process Industries. Khanna Publishers, New Delhi.

Notes