ACADEMIC REGULATIONS
(UNDER-GRADUATE COURSES)

These rules shall be applicable to the students admitted in the undergraduate programmes of the faculties of Agriculture, Dairy and Food Technology, Engineering, Home Science and Horticulture & Forestry of the university.

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 credit.

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 student's 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' (Overall Grade Point Average) 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. First year means the first academic session of the prescribed course of a degree programme. Second year, third year, and fourth year mean second, third and fourth academic sessions, respectively.

1.10 'Odd Semesters' means all the first semesters of each academic year, i.e., first, third, fifth and seventh semesters.

1.11 'Even Semesters' means all the second semesters of each academic year, i.e. second, fourth, sixth and eighth semesters.

1.12 '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 The students admitted to degree programmes of the various faculties of the university shall have to complete a fixed programme of study distributed over four academic sessions comprising of eight semesters.

2.2 Under each degree programme the courses to be taught /examined in each of the eight semesters shall be prescribed by the academic council. The prescribed courses, including title, credit, maximum marks, etc. will be given in the 'Course Description' of the faculty/department concerned.

2.3 Minimum residential requirement and maximum period for all the programmes shall be as under :

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 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 (MT)**

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.

3.2 **Distribution of maximum marks for the mid-term examination, final theory examination and practical examination shall be as follows :**

Courses	**Mid-Term Examination**	**Final Examination (University)**	**Total**

		Theory (Th)	Practical (P)	
Both theory and practical	20	50	30	100
Theory only	20	80	-	100
Practical only	20	-	80	100

3.3 **Distribution of maximum marks for the final practical examination shall be as under :**

Particulars / Maximum Marks	Course with both theory and practical (30)	Course with practical only (80)
(a) Practical record, attendance and day-to-day assessment (Sessional work done)	12	32
(b) Practical exercises as decided by the external examiner	12	32
(c) Viva-voce	6	16

3.4 **Grading System**

(a) 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) 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.

(b) 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 SGPA and OGPA are given by the following formulae.

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

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

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

3.5 **Pass Requirements**

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

(b) To 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.

(c) The minimum OGPA required for the degree is 5.00

3.6 **Provision for Carrying Over of Backlogs**

A student can carry over maximum six failed courses irrespective of even/odd semester in a year as backlog to higher class subject to the conditions prescribed in regulation 3.7, provided he/she is otherwise qualified for promotion to higher class.

3.7 **Promotion to Higher Classes**

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

(b) A student will be promoted to higher class if he/she secures an OGPA as mentioned in the table below and the total number of backlog courses do not exceed as specified in Rule 3.6.

Year to which promotion is being considered	Minimum OGPA required for promotion
Second	4.00
Third	4.50
Fourth	4.75 (with no backlog of I year)

(c) 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 that year's first semester examination.

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

3.8 **Clearing of Backlogs and Repeating of Courses for Improvement of OGPA**

(a) All 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. A student getting less than 40% marks (Grade Point less than 4.0) in a course 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 course(s).

However, if the backlog course is as a result of being detained on account of shortage of attendance, the student has to appear in both the theory and practical examinations in

the subsequent semester as regular course or as a contact course, if time table adjustment is not possible. The mid-term marks awarded (if any) for the detained course(s) shall be carried over whenever the student clears the backlog.

(b) Carry-over of Mid Term marks.

1. Mid term marks obtained by a student will not be carried over for backlog examination and the student will be awarded proportionate marks.

(c) The students can repeat course(s) in the main examination(s) of semester(s) in which such course(s) are regularly offered so as to improve their OGPA, subject to the conditions that only such course(s) will be permitted to repeat in which the grade point obtained is less than 5.00 and the total/additional number of courses in the semester examination (including any backlog courses from previous odd or even semesters, as the case may be) do not exceed nine/three for ex-student/regular students respectively. The student shall have to appear in both the theory and practical of the course. No course of first year will be allowed to be repeated for improvement of OGPA in final year of the degree programme.

He/she shall not be required to attend regular classes for such course(s). The mid-term marks from the previous examination shall be carried over.

Note - *The students have to make a written requisition to the Dean within one month of the commencement of the semester in which the facility is to be availed and also deposit the prescribed fee.*

(d) The grade point obtained as a result of the examination shall replace the original grade point in the course. Such courses will be designated by a letter R.

3.9 **Special Backlog Examination**

1. **In case student has completed VIII semester and has backlog in only one course of either of VII or VIII semester and no backlog of I to VI semester.**

(a) Special examination will be conducted in the month of September/October of First Semester of the academic year for only one course of either of VII or VIII semester.

(b) Student will be charged fee of Rs. 1000/- (Rs. One Thousand only).

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

(d) In case if a student chooses for re-evaluation the examination will be conducted along with regular examination of next semester only, i.e. once in a semester.

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

2. **In case a student has completed VIII semester and has got backlog of up to six courses irrespective of semester :**

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

(b) If regular examination is being conducted for a particular paper, he/she would have to pay normal fee for that papers and special fee of Rs. 1000/- per paper will be charged for the courses which are not listed for conducting the examination in that semester.

(c) If a student does not clear one or more backlog courses, he/she will have to appear as Ex-Student along with regular examination in the next semester and fee will be charged at regular rate, if the courses are listed for conducting the examinations in that semester, otherwise, special fee of Rs. 1000/- will be charged.

3.10 **Scrutiny of Marks/Re-Checking of Results**

A student can apply for scrutiny of marks/re-checking of results along with the prescribed fee within a specified period. This facility will be restricted only to (a) re-totalling of marks obtained, and (b) re-marking of any question(s) left unchecked by the examiner. A student of final year of a degree programme, applying for this facility will be required to give an undertaking that he/she has not applied for migration/provisional degree certificate.

3.11 **Re-evaluation**

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

(ii) Re-evaluation is NOT permissible in the answer books of unfairmeans case(s).

(iii) Re-evaluation shall be permissible in maximum 2 out of the total theory papers of final examination of the semester.

b. The candidate may apply for re-evaluation within 11 days of the issue of the marks-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.

c. The re-evaluation fee per paper shall be Rs.500/- and will not be refundable on any pretext.

d. Fee deposited for the purpose of re-evaluation shall not be refunded in any case.

e. Re-evaluation shall be done by an examiner of the subject to be appointed by the vice-chancellor.

f. The marks obtained after re-evaluation of the paper shall be final and awarded.

g. Marks obtained after re-evaluation shall not be considered for award of merit.

h. (i) 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.

(ii) 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.

4.0 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 are given below:

	Branch of Engineering	Duration	Year
(a)	Agriculture*	30 + 30 = 60 days	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 2 months training programme, the agricultural engineering graduates have to under go in plant training (4 months or 2 months each) or for experiential learning (4 month) in the second semester of final year BE.(Ag.).*

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 cafeteria courses and in-plant training / experiential learning/project.

Senior most Head of the Department - *Convenor*

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.*

5.0 GENERAL RULES PERTAINING TO EXAMINATIONS

5.1 A student can take advantage of proportionate marks based on the final semester examination if he/she misses the mid semester test(s) subject to the condition given below :

(i) The students who are deputed by the university.

(ii) The students, if he/she is hospitalized on the day of examination.

5.2 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.

5.3 The question paper in the university main semester examination shall have four units having two questions each. The students shall have to attempt five questions in all and at least one question from each unit.

5.4 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.

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

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

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 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 If a student absents continuously for 7 working days in a semester in any subject, his/her registration in the semester will be cancelled and parents informed

accordingly. Such students will be provided an option for re-admission in the course/programme within 7 days of the cancellation of their registration by paying a fee of Rs. 500/-.

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 marksheet 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 educational tour, 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.E.

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.E.

The diploma holders from the Board of Technical Education, Rajasthan with 10+2 qualification can seek direct admission in second year B.E. 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 and above

SCHEME OF TEACHING AND EXAMINATION
(Agricultural Engineering)

First Year B.E. (Common for All Branches)

I-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th	P	L	T	P	Th	P	MT
BS 111	Mathematics - I	3	0	3	0	0	80	-	20
ME 113	Mechanical Engineering - I	3	0	3	0	0	80	-	20
ME 114	Workshop Practice	0	1	0	0	3	0	80	20
CE 115	Engineering Drawing	0	1	0	0	3	0	80	20
	NCC/NSS/NSO[1]	-	-	0	0	2	-	-	-
GROUP I									
BS 100P	Engineering Physics	2	1	2	0	2	50	30	20
CE 100	Engineering Mechanics	2	1	2	0	2	50	30	20
EE 100	Electrical Engineering - I	3	1	3	0	2	50	30	20
ENVS 100	Environmental Studies	2	1	2	0	2	50	30	20
GROUP II									
BS 100C	Engineering Chemistry	2	1	2	0	2	50	30	20
EC 100	Electronics and Instrumentation	3	1	3	0	2	50	30	20
CS 100	Introduction to Computer Programming and Data Structure	3	1	3	0	2	50	30	20
BS 100E	English and Communication Skill[2]	2	0	2	0	0	80	-	20
	Total	15/16	6/5	15/16	0	16/14	-	-	-
Total Credits/Hours/Marks		21		31/30			800		

[1] NCC/NSS/NSO is compulsory 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, ENVS 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	T	P	Th	P	MT
BS 121	Mathematics - II	3	0	3	0	0	80	-	20
CE 122	Civil Engineering	1	1	1	0	2	50	30	20
ME 123	Machine Drawing - I	0	1	0	0	3	0	80	20
ME 124	Workshop Technology	2	1	2	0	3	50	30	20
	NCC/NSS/NSO[1]	-	-	0	0	2	-	-	-
GROUP I									
BS 100C	Engineering Chemistry	2	1	2	0	2	50	30	20
EC 100	Electronics and Instrumentation	3	1	3	0	2	50	30	20
CS 100	Introduction to Computer Programming and Data Structure	3	1	3	0	2	50	30	20
BS 100E	English and Communication Skill[2]	2	0	2	0	0	80	-	20
GROUP II									
BS100P	Engineering Physics	2	1	2	0	2	50	30	20
CE 100	Engineering Mechanics	2	1	2	0	2	50	30	20
EE 100	Electrical Engineering - I	3	1	3	0	2	50	30	20
ENVS 100	Environmental Studies	2	1	2	0	2	50	30	20
	Total	16/15	6/7	16/15	0	16/18	-	-	-
Total Credits/Hours/Marks		22		32/33			800		

[1] NCC/NSS/NSO is compulsory 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.E.

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
CE 211 (AE, EE, MI)	Strength of Materials	2	1	2	1	2	50	30	20
PF 212	Introductory Food Engineering	1	1	1	0	2	50	30	20
AG 213	Fundamentals of Agriculture	3	1	3	0	2	50	30	20
EE 213 (AE, ME, MI)	Electrical Engineering - II	2	1	2	0	2	50	30	20
FM 214	Farm Power	2	1	2	0	2	50	30	20
ME 215 (AE)	Heat and Mass Transfer	2	1	2	0	2	50	30	20
SW 216	Hydrology	2	1	2	0	2	50	30	20
	NSS/NCC/NSO[2]	-	-	0	0	2	-	-	-
	Total	17	7	17	1	16	-	-	-
Total Credits/Hours/Marks		24		34			800		

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 221 (AE, MI)	Fluid Mechanics	2	1	2	0	2	50	30	20
CE 222 (AE)	Surveying	2	1	2	0	3	50	30	20
CE 223 (AE)	Soil Mechanics	2	1	2	0	2	50	30	20
ME 224 (AE)	Theory and Design of Machines	3	0	3	0	0	80	-	20
SW 225	Soil and Water Conservation Engineering	3	1	3	0	2	50	30	20
PF 226	Food Process Engineering	2	1	2	0	2	50	30	20
FM 227	Farm Machinery and Equipment - I	2	1	2	0	2	50	30	20
FM 228	Field Operations and Maintenance of Tractors	0	1	0	0	2	-	80	20
	NSS/NCC/NSO[2]	-	-	0	0	2	-	-	-
	Total	16	7	16	0	17	-	-	-
Total Credits/Hours/Marks		23		33			800		

[2] NSS/NCC/NSO is compulsory and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

Note: *Students have to undergo a practical training of 30 days at the end of IV semester during summer break for which the assessment will be made at the beginning of the next semester.*

V-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th	P	L	T	P	Th	P	MT
FM 311	Farm Machinery and Equipment - II	2	1	2	0	2	50	30	20
RS 312	Renewable Energy Sources	2	1	2	0	2	50	30	20
ME 313 (AE)	Refrigeration and Air Conditioning	2	1	2	0	2	50	30	20
PF 314	Post Harvest Engineering	2	1	2	0	2	50	30	20
SW 315	Wells and Pumps	2	1	2	0	2	50	30	20
CE 316 (AE)	Design of Structures	2	1	2	0	2	50	30	20
CE 317 (AE)	Construction Technology	2	1	2	0	2	50	30	20
AG 318	Agri. Business Management and Entrepreneurship Development	3	0	3	0	0	80	-	20
	Total	17	7	17	0	14	-	-	-
Total Credits/Marks/Hours		24		31			800		

T - Tutorials do not carry any credit

VI-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th	P	L	T	P	Th	P	MT
PF 321	Drying and Storage Engineering	2	1	2	0	2	50	30	20
PF 322	Dairy and Food Engineering	2	1	2	0	2	50	30	20
ME 323 (AE)	Computer Aided Design and Manufacturing	2	1	2	0	2	50	30	20
FM 324	Tractor Systems and Controls	2	1	2	0	2	50	30	20
FM 325	Field Operations and Maintenance of Farm Machinery	0	2	0	0	4	0	80	20
SW 326	Irrigation Engineering	3	1	3	0	2	50	30	20
SW 327	Drainage Engineering	2	1	2	0	2	50	30	20
EC 328 (AE)	Microprocessor and Logic Circuits	2	1	2	0	2	50	30	20
	Total	14	10	14	0	20	-	-	-
Total Credits/Hours/Marks		24		34			800		

Note: *Students have to undergo a practical training of 30 days 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.E.

VII-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th	P	L	T	P	Th	P	MT
AE 411	Project	0	6	0	0	12	0	100	-
AE 412	Seminar	0	1	0	0	2	0	100	-
Student will have to take minimum of 15 credits courses from the following									
PF 411	Food Packaging Technology	2	1	2	0	2	50	30	20
PF 412	Development of Processed Products	2	1	2	0	2	50	30	20
PF 413	Food Processing Plant Design and Layout	2	1	2	0	2	50	30	20
PF 414	Agricultural Structures and Environmental Control	2	1	2	0	2	50	30	20
PF 415	Principles of Food Preservation	2	1	2	0	2	50	30	20
PF416	Horticultural Crop Processing	2	1	2	0	2	50	30	20
SW 411	Micro Irrigation Systems Design	2	1	2	0	2	50	30	20
SW 412	Watershed Planning and Management	2	1	2	0	2	50	30	20
SW 413	Minor Irrigation and Command Area Development	2	1	2	0	2	50	30	20
SW 414	Gulley and Ravine Control Structures	2	1	2	0	2	50	30	20
SW 415	Remote Sensing and GIS Applications	2	1	2	0	2	50	30	20
SW 416	Reservoir and Farm Pond Design	2	1	2	0	2	50	30	20

Course No.	Title	Credit		Hours/Week			Marks		
		Th	P	L	T	P	Th	P	MT
SW417	Ground Water Recharge Technology	2	1	2	0	2	50	30	20
FM 411	Tractor Design and Testing	2	1	2	0	2	50	30	20
FM 412	Hydraulic Drive and Controls	2	1	2	0	2	50	30	20
FM 413	Farm Power and Machinery Management	2	1	2	0	2	50	30	20
FM 414	Human Engineering and Safety	2	1	2	0	2	50	30	20
FM 415	Mechanics of Tillage and Traction	2	1	2	0	2	50	30	20
FM 416	Land Development and Grading	3	0	3	0	0	80	0	20
FM 417	Pesticides Application and Equipment	2	1	2	0	2	50	30	20
RS 411	Renewable Power Sources	2	1	2	0	2	50	30	20
RS 412	Greenhouse Technology	2	1	2	0	2	50	30	20
RS 413	Environmental Engineering	2	1	2	0	2	50	30	20
RS 414	Waste and By-product Utilization	2	1	2	0	2	50	30	20
RS 415	Energy Management	3	-	3	0	-	80	-	20
BS 411	Operation Research	3	0	3	0	0	80	0	20
ME 411 (AE)	Production Technology of Agricultural Machinery	2	1	2	0	2	50	30	20
ME 416 (a)	Finite Element Method	3	0	3	0	0	80	0	20
STAT 411	Statistical Methods for Engineers	3	0	3	0	0	80	0	20
Gen 410	Entrepreneurship Development[1]	-	-	0	0	2	-	-	-

[1] Internal assessment

Total Credits : 22

Total Marks : 700

VIII-SEMESTER

Students will undertake practical training and educational tour of 24 credit hours.

Course No.	Title	Credit		Duration	Marks		
		Th	P		Th	P	MT
AE 421	**Practical Training and Educational Tour** Two hands-on training programme, during summer breaks of second year and third year	0	4	each of four weeks	-	100	-
AE 422	**Experiential Learning** Practical training at the Institution, Industrial Training	0	16	4 months 4 months or 2 months each		100	
	Total	0	20		-	-	-
Total Credits/Marks		20			200		

- 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

COURSE CONTENTS

FIRST YEAR B.E. (I SEMESTER)

BS 111 MATHEMATICS – I

Cr. Hrs. 3 (3 + 0)

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

Unit-I

Taylor's and Maclaurin's expansions; Asymptotes, Curvatures, Simple curve tracing.

Unit-II

Partial differentiation; Homogeneous functions and Euler's theorem; Composite functions and total differential coefficient; Jacobians; Error and Approximations.

Unit-III

Double and Triple integrals; Change of order of integration; Rectification of standard curves; Volumes and surfaces of revolution of curves.

Unit-IV

Differential equations of higher order with constant coefficients: Methods of finding complementary functions and particular integrals; Homogeneous equations with constant and variable coefficient.

Text Books/References

1. Y.N. Guar and C.L. Koul. (2005). Engineering Mathematics, (Vols.-I, II), Jaipur Publishing House, Jaipur.
2. N.P. Bali and N.Ch.S.N. Iyengar. (2003). A text book of Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi.

ME 113 MECHANICAL ENGINEERING – I

Cr. Hrs. 3 (3 + 0)

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

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. First Law applied to steady flow processes.

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

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, measurement of dryness fraction.

Unit-III

Vapour Power Cycles: Introduction, Carnot Cycle. Desirable properties of working fluid used for power plants. Rankine cycle. Expansive and non expansive working.
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, saturation curve and missing quantity, governing.

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. Valve timing diagrams. Comparison of petrol and diesel engines. Simple carburettor. Ignition system of SI engine, diesel fuel pump and injectors.

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. Thermal Engineering. 2nd Ed., Scientific Publishers, Jodhpur.

ME 114 WORKSHOP PRACTICE

Cr. Hrs. 1 (0 + 1)

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

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**

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.

Text/Reference

1. N.D. Bhatt. Elementary Engineering 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, Satry 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**

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: **A**nalysis 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**

(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**

Unit-I

D.C. Networks: Kirchoff's law, node voltage and mesh current methods, delta-star and star delta transformation, source conversion; solution of DC circuits by network theorems: Thevenin's, Norton's, superposition, Reciprocity and Maximum Power Transfer theorem.

Unit-II

Single Phase A.C.Ciruits : 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

Three Phase A.C., Circuits : Three phase EMF generation, delta and star-connection, line and phase quantities, solution of the 3- phase balanced circuits, Phasor diagram, measurement of power in three phase balanced circuits.

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.

Unit-IV

Electrical Measuring Instruments : Introduction; type of measuring Instruments, Deflecting controlling & Damping Torque, D.C. PMMC instruments, shunts and multipliers, Moving iron ammeters and voltmeter, Dynamometers wattmeter, Induction type energy meter.

Practicals :
Based on theory

Text Books/References

1. B. L. Therja. 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 Nikhal 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.

ENVS 100 ENVIRONMENTAL STUDIES

Cr. Hrs. 3 (2 + 1)

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

Unit–I

The Multidisciplinary nature of environmental studies:

Definition, scope and need for public awareness. Environmental problems and their consequences

Natural Resources:

Renewable and non-renewable resources
Natural resources and associated problems

a) Forest resources: Use over-exploitation, deforestation, and case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams, benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer- pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land and a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use resources for sustainable lifestyles.

Unit-II

Ecosystems

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

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rovers, oceans, estuaries)

Biodiversity and its conservation

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

Unit-III

Environmental Pollution

Definition, Causes, effects and control measures of: -

Air pollution

Water pollution

Soil pollution

Marine pollution

Noise pollution

Thermal pollution

Nuclear hazards

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

Unit-IV

Social Issues and the Environment - From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns, Case studies, Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland

reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Human Population and the Environment

Population growth, variation among nations, Population explosion- Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies

Practicals

Visit to river, forest, hill, mountain, local polluted plant, pond ecosystem

Text Books/References

1. K. C. Agarwal. (2001). Environmental Biology, Nidi Publications, Bikaner.
2. B. L. Chaudhary and Jitendra Pandey. (2005). Environmental Studies, Apex Publishing House, Udaipur.
3. H Jhadav & V. M. Bhosale. Environmental Protection & Laws, Himalaya Pub. House, Delhi
4. M. N. Rao and A. K. Datta. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
5. B. K. Sharma. Environmental Chemistry. Goel Publishing House, Meerut
6. Pratap Singh, N. S. Rathore and A. N. Mathur. (2004). Environmental Studies, Himanshu Publications, Udaipur.
7. R. K. Trivedi 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**

Unit-I

Sources of water, common impurities, requisites of drinking water in municipal water supply. Purification of water, sedimentation, sterilization, break point chlorination. Hardness, determination of hardness by Complixemetric (EDTA) method, degree of hardness, chloride, dissolved oxygen, carbon dioxide and sulphate, control of pH of water used in industry, 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, coal origin and its classification, Proximate and ultimate analysis of coal, significance of constituents, Gross and net calorific values. Liquid fuels-advantages, Petroleum origin, classification, Refining of Petroleum, Gasoline, knocking, octane number, anti knock agents . Flue gas analysis by Orsat Apparatus, Calculations based on combustion.

Unit-III

Corrosion: Definition and its significance, theories of corrosion, protection of corrosion use of inhibitors and passavasion, Alloying protective coatings -Metallic, inorganic and Organic.

Refractories: Definition, Properties, Classification. Properties of Silica and Fireclay refractories.

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, Numericals of first and second order reactions.

Practicals

1. Determination of viscosity of a liquid.
2. Determination Surface Tension of a liquid by Stalagmometer method.
3. Determination of carbonate and non carbonate hardness by soda reagent method.
4. Determination of temporary and permanent hardness by EDTA method.
5. Estimation of free chlorine in a water sample.
6. Determination of copper sulphate iodometrically.
7. Estimation of potassium dichromate iodometrically
8. Determination of purity of Ferrous Ammonium Sulphate (Mohr's Salt) using Potassium Permanganate.
9. Determination of Potassium Dichromate using Potassium Ferrycyanide as an external indicator.
10. Estimation of available chlorine in bleaching powder sample
11. Analysis of Brass
12. Analysis of Iron ore
13. Analysis of Pyrolusite
14. Analysis of common salt.

Text Books/References

1. Jain and Jain. Engineering Chemistry, Dhanpat Rai & Sons, Nai Sarak, Delhi.
2. Jain and Gupta. A Text Book of Engineering Chemistry, Jaipur Publishing House.
3. B.K. Sharma. Engg. Chemistry, Krishna Prakashan Media (P) Ltd., Merrut.
4. S.S. Dara. A Text Book of Engineering Chemistry, S.Chand & Co., New Delhi.
5. M.A. Uppal. A Text Book of Engineering Chemistry, Khanna Publishers, Delhi.
6. S.S. Dara. A Text Book on Experiments and Calculations Engg. Chem. Ram Nagar, Delhi.
7. S.K. Banerji and S.K. Jain. Hand Book of Technical Analysis, Jain Brothers, New Delhi.

EC 100 ELECTRONICS AND INSTRUMENTATION

Cr. Hrs. 4 (3 + 1)

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

Unit-I

Passive Components: Construction and characteristics of carbon composition , wire wound and film resistors. Potentiometer, color codes and rating of resistors. Characteristics and rating of capacitors for electronics circuits.
Semi conductor: Basic electrical characteristics of semi conductors. Theory of p-n junction. Characteristics and ratings of junction diodes.basics of zener diode, photo diode and LED.

Unit-II

Bipolar Junction Transistor: npn and pnp transistors,, Various configurations (CB, CC,CE) of BJT. Transistor biasing (Fixed, self, potential dividers) Basic classification of amplifier (Voltage and power amplifier). Basic concept of Class A, B , AB and C amplifiers.

Unit-III

Generation of waveforms: Concept of positive and negative feed back. Introduction of oscillators like R-C , L-C and Crystal oscillators.
Power supply: Circuit configuration and analysis of Half wave , Full wave and Bridge rectifier .Basic concept of regulation, Zener diode voltage regulator.,Transistor serier regulator.

Unit-IV

Transducers: Definition, classification : Active and passive transducer, primary and secondary transducers, Analog and digital transducers. Measurement of displacement, temperature, velocity, force and pressure using potentiometer, resistance thermometer, thermocouples , bourden tube, LVDT, strain gauge and techogenerator.

Practicals
Based on theory

Text Books/References

1. Millman and Halkias. Integrated elecronics: Mc Graw Hill
2. W.D Cooper. Electronics Instrumentation and Measurement : PHI
3. M.L.Gupta. Electrical Engineering Materials
4. Malvino. Principles of Electronics
5. Jhon D. Ryder. Electronics Fundamentals

CS 100 INTRODUCTION TO COMPUTER PROGRAMMING AND DATA STRUCTURE

Cr. Hrs. 4 (3 + 1)

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

Unit–I

Computer Fundamentals: History of Computers; Organization of Computers: input unit, output unit, Storage Unit, Arithmetic Logic Unit, Central Processing Unit; CPU Operation; Memory Subsystem: RAM, ROM, Cache Memory & memory Hierarchy; Instruction Format and Instruction Execution Cycle; Number System & Codes: Binary, Decimal, Octal & Hexadecimal Number System, Conversion from one number system to another, sign magnitude, 1's Complement & 2's Complement representation of numbers; Numerical & Character codes: BCD, Excess – 3, Gray, ASCII & EBCDIC Codes.

Unit-II

Basics of Programming in C: Constants, Variables and Data Types, Operators and Expressions, Input and Output operations, Decision making & Branching: if-else, switch statement; Decision making and looping; Arrays.

Unit-III

Character Arrays & strings, User defined function, Structures & Unions, Pointer Management, Dynamic Memory allocation & linked lists.

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 linked list – Representation of linked list in memory, Traversing, Searching, Insertion & Deletion in a linked list.

Practicals
Based on Theory

Text Books/References

1. E. Balagurusamy. "Programming in ANSI C", Tata McGraw Hill.
2. Kernighan and Ritchie. "The C Programming language", Printice Hall
3. P.M. Jat. "Programming with C", Apex Publishing House, Jaipur.
4. Dharm Singh. "Fundamentals of Compute Organization", Paragon International Publishers, New Delhi.
5. P.K. Sinha & P. Sinha. "Computer Fundamentals", BPB Publication.
6. Seymour Lipschutz. "Data Structure", Schaum's outline series, McGraw Hill.

BS 100E ENGLISH AND COMMUNICATION SKILL

Cr. Hrs. 2 (2 + 0)

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

(A) ENGLISH

Grammar and Usage – Tenses, Agreement of Subject and verb, Passive Voice, Basic Sentence Patterns, Prepositions, Phrasal verbs, Common Grammatical Errors, Use of articles, Punctuations, Modals, Gerund, Participle, Infinitive, Word Formation (affixes, prefixes, suffixes, synonyms and antonyms), Idioms, Synthesis & Transformation of sentences, Sentence Linkers.

Comprehension – Unseen Passage

Composition – Precise writing, Personal Letters, Business letters, Job Applications, Writing of technical Report, Essay writing

Introduction to sounds – Vowels, Diphthong, Consonants Phonetics Transcriptions. Word stress and exercises on pronunciation, Group discussion on current topics and Presentation of Technical report.
Practice in Language Laboratory

(B) COMMUNICATION SKILL
Communication Skills: Meaning and process of communication, Verbal and non-verbal communication; Quality of good communicator; Writing skills, Group discussion; Organizing seminars and conferences.

Text Books/ References

1. Thomson and Martinet. (1997). A Practical English Grammar Exercise Book, Vol. I and II, O.U.P. Publication.
2. Michal Swan. (1995). Practical English Grammar, O.U.P. Publication.
3. David Green. (1990). Contemporary English Grammar Structure Composition, Macmillan Publication.
4. S. Allen. (1997). Living English Structures, Orient Longmans.
5. Daniel Jones, Drills and Tests in English Sound, ELBS.
6. Hornby. (1990). Advanced Learners Dictionary, O.U.P. Publication.
7. Kirshan Mohan. Speaking English Effectively; Macmillan Publication.
8. Audio-Video Tapes prepared by the British Council, New Delhi and Central Institute of English and Foreign Language, Hyderabad to be used in a Language Laboratory.
9. A. Adivi Reddy. Extension Education, Sree Lakshmi Press, Bapatla (A.P.)
10. G.L. Ray. (2005). Extension Communication and Management, Kalyani Publishers.

BS 121 MATHEMATICS – II

Cr. Hrs. 3 (3 + 0)

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

Unit-I

Differentiation of Vectors: scalar and vector point functions, vector differential operator Del, Gradient of a scalar point function, Divergence and Curl of vector point functions; Directional derivatives; Line, Surface and Volume integrals; Gauss, Stoke's and Green theorems (Statement only) and their applications.

Unit-II

Ordinary Differential Equations: Second order differential equations with variable coefficients; Exact form; Part of complimentary function is known; Change of dependent and independent variables; Method of variation of parameters.

Unit-III

Partial Differential Equations: Formation of partial differential equations; Lagrange's linear equations; Higher order linear partial differential equations with constant coefficients. Standard forms of partial differential equations.

Unit-IV

Matrices: Elementary transformations; Rank of a matrix; Reduction to normal form; Gauss Jordan method to find inverse of a matrix; Consistency and solutions of linear equations; Eigen values and Eigen vectors**;** Cayley-Hamilton theorem.

Text Books/References

1. Y.N. Guar and C.L. Koul. (2005). Engineering Mathematics, (Vols.-I, II), Jaipur Publishing House, Jaipur.
2. J.L. Bansal and H.S. Dhami. (2005). Differential Equation, (Vols.-I), Jaipur Publishing House, Jaipur.
3. N.P. Bali and N.Ch.S.N. Iyengar. (2003). A text book of Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi.

CE 122 CIVIL ENGINEERING

Cr. Hrs. 2 (1 + 1)

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

(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)

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

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, multistart 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 ML 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**

Unit-I

Welding: Introduction to welding, types of welding. Oxyacetylene gas welding, types of flames, welding techniques and equipment. Principle of arc welding, equipment and tools. Soldering and Brazing.

Unit-II

Lathes: Classification, 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.
Measurement and Inspection: Classification of measuring instruments, linear and angular measurement, comparators.

Unit-IV

Forming: Basic descriptions and applications of hot and cold working processes, forging, bending, shearing, drawing and forming operations.
Foundry: Moulding tools and equipments. Moulding sands, properties of moulding sand, sand mould making process.

Practicals

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

Text Books/References

1. 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.E. (III SEMESTER)

BS 211 (All Branches) MATHEMATICS – III

Cr. Hrs. 3 (3 + 0)

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

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.

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

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Fundamentals : Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagram's, 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 modulic. 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 concentric 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 Lzod 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. Revision.
14. Revision.
15. Revision.

Text Books/References

1. S.B. Junarkar and H.J. Shah. (1997). Mechanics of Structures Vol.-I Charoter Publishing, Opp.- Amul Dairy, Court Road, Anand
2. B.C. Punmia. (1990). Strength of Materials and Mechanics of Structures, Vol-I. edition, Standard publisher distributors, Nai Sarak, New Delhi – 19.

PF 212 INTRODUCTORY FOOD ENGINEERING

Cr. Hrs. 2 (1 + 1)

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

Unit-I

Introduction to food engineering, units and dimensions, introduction to mass and energy balance, simple food processing operations, problems based on of mass and energy balance of simple food processing operations.

Unit-II

Fluid flow in food processing: properties of liquid, handling system for Newtonian liquid, mechanical energy balance, flow measurement, flow past immersed bodies, drag, drag coefficient, motion of particle through fluid, equation for one dimensional motion of particle through fluid.

Unit-III

Heat transfer in food processing, conduction, conduction through bodies in series and parallel, convection, overall heat transfer coefficients, natural and forced convection.

Unit-IV

Introduction to Psychrometry, psychrometric properties, psychrometric chart, various psychrometric processes, application of psychormetry in simple food processing operations.

Practicals

1. Study of applications of dimensional analysis.
2. Study of simple processes for mass balance in food processing
   (a) Evaporation (b) Drying
3. Study of simple processes for energy balance in food processing
   (a) Evaporation (b) Drying
4. Study of pumping systems for liquid food processing plants.
5. Determination of energy requirement for pumping in liquid food processing plants.
6. Study of flow past immersed bodies.
7. Study of heat transfer calculations for various shapes.
8. Study of cooling load calculations for food industries.
9. Calculations of drag coefficients for various shapes.
10. Determination of liquid properties
    (a) Density (b) Viscosity

Text Books/References

1. R. C. Verma and S. K. Jain. (2002). Fundamentals of Food Engineering, Himanshu Publications, New Delhi.
2. R. P. Singh and D. R. Heldman. (1997). II Ed. Introduction to Food Engineering. Academic press.

AG 213 FUNDAMENTALS OF AGRICULTURE

Cr. Hrs. 4 (3 + 1)

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

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.

EE 213 (AE, ME, MI) ELECTRICAL ENGINEERING – II

Cr. Hrs. 3 (2 + 1)

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

Unit-I

D.C. Machines: Characteristics curves of d.c. generators and motors, application of motors for different uses, starting and speed control of motors.

Unit-II

Transformers: Phasor diagram and equivalent circuits, regulation efficiency and their determination. Open circuit, short circuit and Sumpner's test.

Unit-III

Induction Motors: Polyphase induction motors – starters, equivalent circuit, effect of rotor resistance, toruqe-slip curves, speed control by rotor resistance, pole changing and cascading, use in industry. Single phase induction motor – starting methods.

Unit-IV

Alternators: Elementary idea of armature winding. Calculation of induced e.m.f., factors affecting generating e.m.f. Open circuit, short circuit and load characteristics. Voltage regulation and its determination by synchronous impedance methods. Synchronising.

Synchronous Motors: Methods of starting. Power angle characteristics of cylindrical rotor machine, operation of synchronous motor as a condenser and as a reactor. Applications in industries.

Practicals : Lab practicals will be as per the theory syllabus.

Text Books/References

1. Nagrath and Kothari. Electrical Machines.
2. Ashfaq Hussain. Fundamentals of Electrical Engineering.

FM 214 FARM POWER

Cr. Hrs. 3 (2 + 1)

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

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. Study of engine components their construction, operating principles and functions. Simple numerical problems on horse power calculation.

Unit-II

CI Engine systems : valves & valve mechanism. Fuel, intake and exhaust, cooling, lubricating, ignition, starting and electrical systems.

Unit-III

IC engine fuels - their 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 and fuel consumption.

Unit-IV

Study of properties of coolants, anti freeze and anti-corrosion materials, lubricant types and study of their properties. Engine governing systems: centrifugal and pneumatic.

Practicals

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. B.J. Liljedahl, P.K. Turnquist , W.D. Smith and Hoki Vaketo. (1989). Tractor and their Power units. Jhon Wiley & Sons., New York.
2. F.R. Jones. 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.

ME 215 (AE) HEAT AND MASS TRANSFER

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Introductory concepts, modes of heat transfer, thermal conductivity of materials, measurement.

Conduction: General differential equation of conduction. One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation. Electrical analogy. Insulation materials, critical thickness of insulation. Fins.

Unit-II

Convection: free and forced convection. Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free and forced convection. Useful non dimensional numbers and empirical relationships for free and forced convection. Introduction to thermal boundary layer.

Unit-III

Radiation: Introduction. Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor.

Unit-IV

Heat Exchangers: Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers.

Introduction to Mass Transfer: Steady state molecular diffusion in fluids at rest and in laminar flow. Flick's law, mass transfer coefficients. Reynold's analogy.

Practicals

1. To measure thermal conductivity of metal bars.
2. To measure thermal conductivity of insulating powders.
3. To study temperature distribution along the length of fin in natural and forced convection.
4. Experiment on heat transfer in forced convection.
5. Experiment on heat transfer in natural convection.
6. To determine emissivity of given surface.

7. To determine Stefan-Boltzman constant and verify the law.
8. To determine rate of heat transfer, LMTD and overall heat transfer coefficient for parallel flow heat exchanger.
9. To determine rate of heat transfer, LMTD and overall heat transfer coefficient for counter flow heat exchanger.

Text Books/References

1. S. Domkundwar. A Course in Heat & Mass Transfer, Dhanpat Rai & Sons, Delhi.
2. D.S. Kumar. Heat and Mass Transfer, SK Kataria & Sons, Delhi.
3. J. P. Holman. Heat Transfer, McGraw Hill.
4. S.P. Sukhatme. A Text Book on Heat Transfer, Orient Longman.

SW 216 HYDROLOGY

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Introduction; hydrologic cycle; precipitation - forms, rainfall measurement, mass curve, hydrograph, mean rainfall depth, frequency analysis of point rainfall, plotting position, estimation of missing data, test for consistency of rainfall records.

Unit-II

interception; infiltration; evaporation; evapo-transpiration - estimation and measurement; geomorphology of watersheds - stream number, stream length, stream area, stream slope and Horton's laws; runoff - factors affecting, measurement; stage and velocity, rating curve, extension of rating curve; Estimation of peak runoff rate and volume; rational method, Cook's method, SCS method, Curve number method.

Unit-III

Hydrograph; components, base flow separation, unit hydrograph theory - unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph.

Unit-IV

Head water flood control - methods, retards and their location; flood routing - graphical methods of reservoir flood routing; hydrology of dry land areas - drought and its classification.

Practicals

1. Visit to meteorological observatory.
2. Study of different types of rain gauges.
3. Exercise on analysis of rainfall data.
4. Double mass curve technique.
5. Determination of average depth of rainfall and frequency analysis.
6. Study of stage recorders and current meters.
7. Exercise on estimation of peak runoff rate and runoff volume.
8. Exercises on hydrograph and unit hydrograph.
9. Exercises on design and location of retards for channel improvement.
10. Exercises on flood routing problems.

Text Books/References

1. Ghanshyam Das. (2000). Hydrology and Soil Conservation Engineering. Prentice Hall of India, New Delhi
2. K. Subramanya. (1993). Engineering Hydrology, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. R.K. Linsley, M.A. Kohler and J.L.H. Paulhus. (1983). Hydrology for Engineers, McGraw Hill International Book Company, London.
4. H.M. Raghunath. (1988). Hydrology, Wiley Eastern Ltd,, New Delhi.
5. Ullah, Wasi, S.K. Gupta and S.S. Dalal. (1972). Hydrological Measurements for Watershed Research, Jugal Kishore and Co., Dehradun.

SECOND YEAR B.E. (IV SEMESTER)

CE 221 (AE, MI) FLUID MECHANICS

Cr. Hrs. 3 (2 + 1)

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

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 compressible and incompressible fluids. Euler's equation of motion. Integration of Euler's equation to give Bernoulli's equation for compressible and incompressible fluids, applications of Bernoulli's equation.

Unit-III

Impulse momentum equation: introduction, Force on pipe bends. Flow through sharp edged orifices, flow through mouth pieces (steady flow condition).

Discharge measurement in pipes and open channels: Venturimeter, orificemeter. Nozzle and pitot tube (steady flow condition). Flow over weirs, and notches (steady flow condition).

Unit-IV

Flow through pipes: Various types. Velocity distribution. Loss of head due to friction. Minor losses, hydraulic gradient, pipes in series and parallel.
Open Channel Flow: Various types, flow equations, geometrical properties of sections, Most economical section.

Practicals

1. Study and use of pressure gauge.
2. Study & use of manometer.
3. Determination of C_C for orifices.
4. Determination of C_V for orifices.
5. Determination of C_d for orifices.
6. Calibration of a Venturimeter.
7. Calibration of V notch.
8. Calibration of Rectangular notch.
9. Determination of friction for pipe.
10. Velocity distribution in channel cross section.

11. Field visit.
12. Field visit.
13. Revision.
14. 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.

CE 222 (AE) SURVEYING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Plane table surveying: Description, construction and use of various accessories and centring, leveling and orientation.
Method of plane table: Radiation, Intersection, Traversing & resection.Two Point problems and their solution by Different methods. Three point problems and their solution by different methods, Great circle method. Advantages and disadvantages of plane table.

Unit-II

Description, construction and use of Theodolite, Tempory adjustments of Theodeolite, Fixing, Centring, leveling and elimination of parallax. various axes and their relationship. Principles of Tacheomertic survey and its field application. Constants of Tachometer. Staff held vertical and inclined. Use of Analytical lensor, calculation of R.L. Use of stadia cross wires.

Unit-III

Contours, contouring and their characteristics. Methods of contour surveying by Theodolites. 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. Calculation of volume by the use of contour and their use in computing the reservoir capacity.

Practicals

1. Setting up of plane table, use of various accessories and practice for orientation and charge of Point.
2. Radiation and intersection method of plane tabling.
3. Two point problem and it solution, three point problem and its solution.
4. Contouring by plane table method.
5. Conducting contour survey in different area their compilation.
6. Study of theodolite, fixing on stand and themporary adjustment, Permanent adjustment of theoddolite and their checking.
7. Horizontal and vertical angle measurements by theodolite.
8. Problems of height and distance.
9. Use of tacheometer with inclined sight and staff held inclined.
10. Contouring by grid method.
11. Contouring by radial line method.
12. Contouring by spot level method.
13. Practice of contour plotting by various methods.
14. Use of planimeter, finding constants and calculation of areas of irregular boundaries.
15. Introduction of total station.

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**

Unit-I

Introduction of Soil Mechanics, field of Soil Mechanics. Phase diagram, physical and index properties of soil. Classification of Soil, general classification based on particle size, textural classification and I.S. Soil classification system.

Unit-II

Stress condition in soils, effective and neutral stress. Elementary concept of Bousinesque and Wester-guards analysis.

Shear strength, Mohr stress circle, theoretical relationship between principal stresses, Mohr-Colomb failure theory, Effective stress principle. Determination of shear parameters by direct shear, theoretical relationship between principle stresses, Triaxial, unconfined compression and vane shear test. Numerical exercises based on various types of tests.

Unit-III

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

Consolidation of soil: One dimensional consolidation spring analogy. Terzaghi's theory of one dimensional consolidation Laboratory consolidation test. Calculation of void ratio and coefficient of volume change, Taylor's and casagrande's method for determination of coefficient of consolidation.

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, plate load test, standard penetration test (introduction). Bearing capacity by building codes, simple numerical exercises.

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.
   (c) Abbot's compaction.
6. Determination of atterberg's limits of soils.
7. Unconfined compression test.
8. Shear box test.
9. Triaxial test.
10. Vane shear test.
11. Consolidation test.
12. Study and use of sampling equipments.

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 224 (AE) THEORY AND DESIGN OF MACHINES

Cr. Hrs. 3 (3 + 0)

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

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, anti friction 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 & D.K. Aggarwal. Machine Design, S.K. Kataria & Sons, Delhi.
6. R. S. Khurmi and J. K. Gupta. A Text Book of Machine Design, S. Chand & Co. Ltd., New Delhi.

SW 225 SOIL AND WATER CONSERVATION ENGINEERING

Cr. Hrs. 4 (3 + 1)

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

Unit-I

Introduction; soil erosion : Causes, types and agents of soil erosion; water erosion - forms of water erosion, mechanics of erosion; gullies and their classification, stages of gully development; soil loss estimation - universal soil loss equation and modified soil loss equation, determination of their various parameters;

Unit-II

Erosion control measures : Agronomical measures - contour cropping, strip cropping, mulching; mechanical measures - terraces - level and graded broad base terraces and their design, bench terraces & their design, layout procedure, terrace planning, bunds - contour bunds, graded bunds and their design; characteristics of contours and preparation of contour maps; land use capability classification;

Unit-III

Wind erosion : Factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, wind erosion control measures - vegetative, mechanical measures, wind breaks & shelter belts, sand dunes stabilization; sedimentation - sedimentation in reservoirs and streams, estimation and measurement, sediment delivery ratio, trap efficiency; gully and ravine reclamation - principles of gully control - vegetative and temporary structures;

Unit-IV

Grassed water ways and their design; introduction to water harvesting techniques; introduction to stream water quality and pollution.

Practicals

1. Study of soil loss measurement techniques.
2. Study of details of Coshocton wheel and multi-slot runoff samplers.
3. Determination of sediment concentration through oven dry method.
4. Problems on Universal Soil Loss Equation.
5. Preparation of contour map of an area and its analysis.
6. Design of vegetative waterways; Design of contour bunding system.
7. Design of graded bunding system.
8. Design of various types of bench terracing systems.
9. Determination of rate of sedimentation and storage loss in reservoir.
10. Design of Shelter belts and wind breaks.

Text Books/References

1. V.V.N. Murty. (1988). Land and Water Management Engineering, Second Edition Kalyani Publishers, New Delhi.
2. A.M. Michael and T.P. Ojha. (1999). Principles of Agricultural Engineering, Vol. II, Third Edition, Jain Brothers, New Delhi.
3. Gurmel Singh , C. Venkataraman, G. Sastri and B.P. Joshi. (1991). Manual of Soil & Water conservation Practices, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. G.O. Schwab, D.D. Frangmier M.J. Elliot and R.K. Frevert. (1995). Soil and Water Conservation and Engineering, Fourth edition, John Villey & Sons Inc.
5. P.K. Singh. (2000). Watershed Management (Design and Practice), e-media publications, Udaipur.
6. R. Suresh. (2002). Soil and Water Conservation Engineering, Fourth Edition Standard Publishers and Distributors, Delhi.
7. Raj Vir Singh. (2003). Watershed Management, Second Edition, Yash Publishing, Bikaner.

PF 226 FOOD PROCESS ENGINEERING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Cleaning and Grading, screening, types of screen, grain size, particle motion on screen, screen opening, ideal and actual screen, screen analysis, fineness modulus, effectiveness of screen. Equipments for cleaning, grading and separations, air screen cleaner, disc separator, indented cylinder separator, spiral separator, specific gravity separator, cyclone separator.

Unit-II

Size reduction, Principal of size reduction, crushing efficiency, energy requirement in size reduction, power requirement in size reduction by Kick's Rittinger's and Bond's laws, size reduction procedures, size reduction equipments, crushers, grinders, attrition mills, hammer mill, cutting machines, performance of size reduction machines.

Unit-III

Introduction to Mixing: Theory of mixing, types of mixtures for dry and paste. materials, rate of mixing and power requirement, mixing index.

Introduction to filtration: Theory of filtration, study of different types of filters, rate of filtration, pressure drop during filtration.

Unit-IV

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

Practicals

1. Determination of fineness modulus
2. Determination of uniformity index
3. Determination of effectiveness of screens
4. Study of cyclone separator
5. Study of air screen cleaner
6. Study of indented cylinder separator
7. Study of specific gravity separator
8. Study of hammer mill
9. Study of attrition mill
10. Study of various cleaning equipment
11. Study of belt conveyor
12. Study of bucket elevator.
13. Study of screw conveyor

Text Books/References

1. K K Singh and K.M. Sahay. (1996). Unit Operations in Agricultural Processing. Vikas Publishing House, New Delhi.
2. S. Henderson and S.M. Perry. (1976). Agricultural Process Engineering. 5th ed. AVI Publishing Co. Inc.
3. McCabe and Smith. Unit Operations in Chemical Engineering, McGraw Hills Book Co.

FM 227 FARM MACHINERY AND EQUIPMENT – I

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Objectives of farm mechanization: Introduction to various farm operation, implement types. Classification of farm machines. Materials of construction. Field capacities, field efficiency and simple numerical problems.

Unit-II

Tillage and its objectives : Primary and secondary tillage equipment; Ploughs-Desi, Mould board, Subsoiler, Rotary tiller and Puddlers. Forces acting on 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. Methods and equipments for interculture and weed control.

Unit-IV

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. plow.
3. Construction details, adjustments and working of disc plow.
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.

FM 228 FIELD OPERATION AND MAINTENANCE OF TRACTORS

Cr. Hrs. 1 (0 + 1)

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

Practicals

1. Introduction to various systems of a tractor viz. fuel, lubrication, cooling, electrical, transmission, hydraulic and final drive system.
2. Familiarisation with tractor controls and learning procedure of tractor starting and stopping.
3. Study of driving safety rules: Road signs, traffic rules, road safety, driving and parking of tractor.
4. Familiarisation with different makes and models of tractors in India.
5. Forward and reverse tractor driving practice.
6. Tractor driving practice with two wheeled tractor trailer forward and reverse.
7. Familiarisation with tools and equipment used for maintaining and servicing of tractors and farm machines; Doing the 10-hours service jobs and Maintenance after 50- hours of operation; Maintenance after 100 hours of operation; Maintenance after 250 hours of operation; Maintenance after 500 hours and 1000 hours of operation.
8. Dismantling and assembling of major engine parts.
9. Visit to tractor/ engine repair workshop.

Text Books / References

1. Jacobs. Co. and R.H. William. Agricultural power and machinery, Mc-Garw Hill Book Company
2. Rai and Jain. Tractor maintenance & repair.
3. Service manuals of various tractors.

FM 311 FARM MACHINERY AND EQUIPMENT – II

Cr. Hrs. 3 (2 + 1)

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

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. Principles of threshing and various types of threshers. Maize harvesting and shelling equipment,

Unit-III

Grain harvesting, types and different functional units of combine. Operation, adjustment, different losses. Numerical problems on losses. Introduction to straw combine. Introduction to plot combines and plot threshers.
Root crop harvesting equipment – potato. Horticultural tools: hand tools and posthole digger.

Unit-IV

BIS Test codes and testing procedure for thresher and combine. 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.

RS 312 RENEWABLE ENERGY SOURCES

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Classification of energy sources; Introduction to renewable energy sources; role of energy in economic development; energy consumption patterns.

Biomass: Introduction to biomass as source of energy and its advantages, Biomass Classification. Characterization of biomass (proximate analysis and ultimate analysis), Biomass combustion.

Biomass conversion technologies (thermo-chemical, biochemical and agrochemical) technology, Biomass gasification technology.

Unit-II

Types, construction, working principle, design & operational parameters, selection of size, site and beneficiaries, uses and safety/environmental aspects of different biomass based renewable energy devices like gasifiers, biogas plants, etc.

Unit-III

Solar passive heating devices, photovoltaic cells and arrays; Brief introduction to wind energy, hydroelectric energy, ocean energy,

Unit-IV

Densification of biomass, briquetting and baling of biomass, bio-diesel preparation and energy conservation in agriculture.

Practicals

1. Preparation of biomass sample.
2. Determination of calorific value.
3. Estimation of ash content of biomass.
4. Estimation of moisture content of biomass.
5. Estimation of fixed carbon and volatile matter of biomass.
6. Demonstration of down draft throatless gasifier.
7. Demonstration of down draft gasifier with throat.
8. Demonstration of gasifier for thermal use.
9. Demonstration of working of a fixed dome type biogas plants.
10. Demonstration of working of a floating drum type biogas plants.
11. Demonstration of biodiesel preparation.
12. Measurement of basic solar parameters.
13. Demonstration of solar water heater.
14. Demonstration of PVC.
15. Demonstration of solar cooker.
16. Demonstration of solar dryer.
17. Evaluation of briquetting machines.

Text Books/References

1. G.D. Rai. Non-Conventional Energy Sources, Kh Publishers, New Delhi.
2. N. S. Rathore. A.K. Kurchania, N.L. Panwar. (2007). Non Conventional Energy Sources, Himanshu Publications.
3. K.C. Khandelwal. & S.S. Mandi. (1990). Biogas Technology.
4. N.S. Rathore. A. K. Kurchania, N.L. Panwar. (2007). Renewable Energy, Theory and Practice, Himanshu Publications.
5. N.S. Rathore. A. K. Kurchania. (2006). Biomethanation Technology, Apex Publications, Udaipur.

ME 313 (AE) REFRIGERATION AND AIR CONDITIONING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Introduction: Second law of thermodynamics applied to refrigeration. Reversed Carnot cycle, coefficient of performance. Unit of refrigeration.

Vapour Compression System: Theoretical vapour compression cycle. Deviation of actual cycle from ideal cycle, undercooling, dry, and wet compression. Compressors, expansion valves, evaporators and condensers.

Unit-II

Vapour Absorption System: Vapour absorption refrigeration system and components.

Refrigerants: Desirable properties of ideal refrigerant. Classification of refrigerants. Important refrigerants like ammonia, Freons. Secondary refrigerants like water and brine.

Unit-III

Psychrometry: Thermodynamic properties of moist air, perfect gas relationship for approximate calculation. Adiabatic saturation process. Wet bulb temperature and its measurement. Psychrometric chart and its use. Elementary psychrometric processes.

Air Conditioning: Types of air conditioning systems, concept of thermal comfort.

Unit-IV

Basics of airconditioning load estimation and space air distribution.

Cooling and Dehumidification: Chilled water spray, surface cooling and dehumidification, sensible cooling with dry coils, direct expansion wet coils. Evaporative cooling. Design of cold storage for perishable products using sensible and latent cooling loads, electrical appliances load, respiration load.

Practicals

1. Study of vapour compression and vapour absorption systems.
2. Study of Electrolux refrigerator.
3. Study and determining COP of ice plant.
4. Study and determining of COP of water cooler.
5. To determine COP of vapour compression refrigeration rig.
6. Study of charging of vapour compression refrigeration system.
7. Study of leak detection devices.
8. Study of evaporative cooling system.

Text Books/References

1. S. Domkundwar and S.C. Arora. Refrigeration and Air Conditioning, Dhapat Rai & Sons, Delhi.
2. J.L. Threlkeld. Thermal Environmental Engineering, Prentice Hall.

PF 314 POST HARVEST ENGINEERING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Importance of engineering of properties of biological materials, study of different physical and thermal characteristics of important biological living materials like shape, size volume density, roundness, sphericity, angel of repose, surface area, sp. Heat, thermal conductivity, color, thermal velocity, chemical composition of grain.

Unit-II

Cleaning and separation, effectiveness of separation, husking of grain, factors affecting and effectiveness of husking, traditional rice milling machine, modern rice milling machinery, general principles of cleaning, open double sieve cleaner and single scraper, drum cleaner, paddy cleaner with destoner, rubber roll husker (Japan type), whiting of grain.

Unit-III

Post harvest engineering of cereals and millets, milling of corn, introduction corn dry milling, tempering, degerming method, corn wet milling method, wheat milling, modern flour milling.

Unit-IV

Milling of pulses and oil seeds, introduction to pulse milling, traditional pulse milling, commercial pulse milling processes, introduction to oil milling, traditional methods for oil milling such as village Ghanis, mechanical oil expeller, pre-treatments for oil milling.

Practicals

1. To find the shape and size of cereals, pulses and oil seeds grains
2. To determine the bulk density of grains
3. To determine porosity of grain
4. Study of cleaner cum grader
5. Study of mechanical oil expeller
6. Study of maize dehusker sheller
7. Study of whole flour mill
8. Study of CFRTI Dal mill
9. Study of CIAE Dal mill
10. Study of modern rice mill
11. Visit to modern flour mill
12. Visit to solvent extraction plant
13. Determination of hardness of grain

Text Books/References

1. A. Chakravorty & D.E. De. (1998). Post Harvest Technology of Cereal and Pulses. Oxford & ISH Publishing Co. Pvt. Ltd., New Delhi.

SW 315 WELLS AND PUMPS

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Occurrence and movement of ground water, aquifer and its types, classification of wells, steady and transient flow into partially, fully and non-penetrating and open wells, familiarization of various types of bore wells common in the state.

Unit-II

Design of open well, groundwater exploration techniques, methods of drilling of wells, percussion, rotary, reverse rotary, design of assembly and gravel pack, installation of well screen, completion and development of well.

Unit-III

Groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's etc. Theis recovery method, well interference, multiple well systems, surface and subsurface exploitation and estimation of ground water potential, quality of ground water, artificial groundwater recharge planning, modelling, ground water project formulation. Pumping Systems: Water lifting devices; different types of pumping machinery, classification of pumps, component parts of centrifugal pumps; pump selection, installation and trouble shooting.

Unit-IV

Design of centrifugal pumps, performance curves, effect of speed on head capacity, power capacity and efficiency curves, effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; priming, self priming devices, rotodynamic pumps for special purposes such as deep well turbine pump and submersible pump.

Practicals

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. Drilling of a tubewell.
7. Measurement of water level and drawdown in pumped wells.
8. Estimation of aquifer parameters by Thies method, Coopers-Jacob method , Chow method, Thies Recovery method.
9. Well design under confined and unconfined conditions, well losses and well efficiency.
10. Estimating ground water balance.
11. Study of artificial ground water recharge structures.
12. Study of radial flow and mixed flow centrifugal pumps, multistage centrifugal pumps, turbine, propeller and other pumps; Installation of centrifugal pump.
13. Testing of centrifugal pump and study of cavitations.
14. Study of performance characteristics of hydraulic ram.
15. Study and testing of submersible pump.

Text Books/References

1. A.M. Michael. Irrigation Theory and Practices.
2. Michael and Thaper. Wells and Pumps.
3. Todd. Ground Water Hydrology.

CE 316 (AE) DESIGN OF STRUCTURES

Cr. Hrs. 3 (2 + 1)

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

(A) REINFORCED CEMENT CONCRETE STRUCTURES

Unit-I

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

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

Types of problems in singly reinforced beams.

Shear stress in R. C. beams, Effect of shear, Reinforcement for shear. I.S. recommendations.

Bond, anchorage, development length.

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

Cantilever: Design of simple cantilever.

Slabs spanning in one direction.

Two way slabs: Supported on four edges with corners not held down and carrying U.D.L.

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-III

Introduction: Common steel sections, Selection criterion for beams and columns.

Design of Beams: Assumptions in the theory of bending, Design of laterally restrained beams, with checks for shear, deflection; Web buckling and crippling, Design steps, Problems.

Unit-IV

Columns: Classification of columns, Types of sections, Strength of column, Design of axially loaded columns. Compound columns. Design of compound column.

Lacing and Battening : Design of lacing, Design of battening, Column bases, Slab bases. Design of slab with concrete block, Problems.

Practicals

R.C.C.:

1. Design of Singly R.C.C. Beams.
2. Design of Doubly R.C.C. Beams.
3. Design of T-Beam.
4. Design of One-way R.C.C. Slab.
5. Design of Axially Loaded R.C.C. Column.

Steel:

6. Design of Laterally Restrained R.S. Beam.
7. Design of Axially Loaded R.S. Beam.

8. Design of R.S. Compound Column.
9. Design of Lacing & Battening.
10. Design of Base Slab and Concrete Block.

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.

CE 317 (AE) CONSTRUCTION TECHNOLOGY

Cr. Hrs. 3 (2 + 1)

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

(A) CONSTRUCTION TECHNOLOGY

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) ESTIMATING COSTING

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.

Practicals

1. To find aggregate crushing value.
2. To perform slump test using slump test apparatus.
3. To perform compacting factor test.
4. To find compressive strength of concrete.
5. Blue print reading & finding dimension for quality calculations.
6. Long-wall & Short wall methods of estimation for one room.
7. Long-wall & Short wall methods of estimation for two room.
8. Centre line method of estimation for one room.
9. Centre line method of estimation for two room.
10. Visiting various sites.
11. Visiting various sites.

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.

AG 318 AGRIBUSINESS MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Cr. Hrs. 3 (3 + 0)

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

Unit-I

Agribusiness: Management: - Concept, process, functions and FOYAL principles of management, Introduction to management by objectives, Concept, of Agribusiness and application of management principles to agribusiness Agriculture products: production, consumption and marketing.

Unit -II

Meaning and theories of International trade, WTO provisions for trade in agriculture and food commodities, Indias contribution to International trade in food and agri- commodities. Project preparation for small scale agri enterprises and appraisal.

Unit -III

Entrepreneurship Development: concept, characteristics, functions & types of entrepreneurs, factors responsible for entrepreneurship .Motivation and leadership in entrepreneurship development, managing an small scale enterprise, constraints perceived in rural entrepreneurship, SWOT analysis Govt. schemes and incentives for promotion of entrepreneurship. Govt. policies on small & medium enterprise.

Unit -IV

Globalization and international emerging business environment, Development of service sector in agribusiness. Contract farming and custom hiring- Its advantages and specific areas. Public- private partnership & its necessity. Fundamentals of Participatory rural appraisal (PRA), Rapid rural appraisal (RRA) techniques and SHG.

Text Books/References:

1. Francis Cherunilam. International Trade and Export Management. Himalaya PublicationHouse, New Delhi.
2. Raja Gopal. Marketing Management. Vikas Publication, New Delhi.
3. B.P. Singh and T.N. Chabbra. An Introduction to organization and Management.Kitab Mahal, New Delhi.
4. Akhouri, M.M. P., Mishra, S.P. and Sen Gupta, R. 1989. Trainers Manual on Developing Entrepreneurial Motivation, UIESBUD, New Delhi.
5. Bidgoli, H.2989. Decision Support Systems: Principles and Practices, St.Paul, West Publishing Co.,USA.
6. Goyal D.P. 1994. Management Information System: Concept and Applicastion, Deep & Deep Publisher, New Delhi.
7. Mancuso, J.1974. The Entrepreneurs Handbook (Vol.1920, Artech House, Inc.,USA.

8. Patel, V.G. 1987. Entrepreneurship Development Programme in India and Its Relevance to Developing Countraies Entrepreneurship Development Institute of India , Ahmedabad.
9.. Rao, T.V. 1974. Development of an Entrepreneur, Indian Institute of Management, Ahmedabad.
10. De ,Dipak and Jirli, Basavaprabhu (2010) A Handbook of Extension Education,AGROBIOS (INDIA).

THIRD YEAR B.E. (VI SEMESTER)

PF 321 DRYING AND STORAGE ENGINEERING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Moisture and its removal, utilities of drying, moisture content representation, various methods for moisture content measurement, EMC, importance of EMC and methods of its determination, EMC curve and EMC model.

Unit-II

Principle of drying, theory of diffusion, various drying rate periods - falling rate and constant rate period of drying, critical moisture content, heat transfer in grain drying, dryer performance, drying methods, classification of dryers and operation.

Unit-III

Importance of storage, types and causes of spoilage in storage, insect/pest of stored grains, changes occurring in food grains during storage Fundamental requirements of storage, traditional storage structures such as Morai, Bukhari, Kothar, mud Kothi *etc.*, bag storage.

Unit-IV

Improved storage structures such as Pusa bin and CAP, temperature and moisture change in storage structures, Deep and Shallow bin, Introduction to grain storage design theories such as Jansen and Rankine, fumigations, controlled and modified atmosphere storage.

Practicals

1. Measurement of moisture content
2. Determination of EMC
3. Determination of ERH
4. Study the effect of temperature on stored grains
5. Study of solar dryer
6. Study of tray dryer
7. Study of fluid bed dryer
8. Measurement of relative humidity during drying
9. Study of drying rate period
10. Design and layout of commercial bag storage facilities
11. Design and layout of commercial bulk storage facilities
12. Study of different traditional storage structures
13. Study of different improved storage structures
14. Visits to commercial handling and storage facilities for grains.

Text Books/References

1. K K Singh and K.M. Sahay. (1996). Unit Operations in Agricultural Processing. Vikas Publishing House, New Delhi.
2. A.M. Michael and T.P. Ojha. Principles of Agriculture Engineering, Jain Brothers, Jodhpur
3. B.K. Bala. (2001). Drying and Storage of Cereal Grains. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi

PF 322 DAIRY AND FOOD ENGINEERING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Composition and properties: Dairy development in India, composition, thermal and chemical properties of milk and milk products.
Cream Separation and Homogenization: centrifugal cream separator, Effect of homogenization of milk, homogenization valve and pump, theory of homogenization, energy requirements, efficiency of homogenization.

Unit-II

Pasteurization: Definition of pasteurization, vat pasteurization; agitation and control in vat pasteurizers, advantages and disadvantages, Plate Heat Exchanger, HTST pasteurization and controls, UHT processing and sterilization.
Butter Handling Equipment: Principle of churning, Churn construction; types of churn,
Thermal processing of foods: Decimal reduction time, thermal death time, spoilage probability**.**

Unit-III

Evaporation: Atmospheric concentrators, vacuum pan, condenser, single and multiple effect evaporators, properties of liquid foods in evaporation, calculation of energy consumption in evaporators, performance evaluation of evaporators, vapour recompression systems.
Drying: Milk dryer, drum or roller dryer, spray dryer, atomization system, cyclone separator, bag filters, heat balance of drying equipment, equipments for instantizing milk powder

Unit-IV

Freezing of foods: Freezing of foods, freezing point depression, calculation of freezing rate using plank's equation, freezing equipments *viz.* air blast freezer, plate freezer, immersion freezer.
Freeze drying: Freeze drying of foods, freeze dryer, calculation of freeze drying time.
Water activity: Role of water and water activity of foods, methods of determination of water activity, control of water activity by addition of solutes and dehydration.

Practicals

1. Study of a milk processing plant & equipments;
2. Study of pasteurizers;
3. Study of homogenizers;
4. Study of separators and butter churns;
5. Study of evaporators;
6. Study of milk dryers;
7. Study of freezers;
8. Determination of D and z value.
9. Determination of fat in milk.
10. Calculation of freezing time.
11. Determination of physical properties of food products;
12. Estimation of steam requirements;
13. Estimation of refrigeration requirements in dairy & food plant;
14. Visit to Food industry.

Text Books/References

1. Tufail Ahmed. (1997) Dairy Plant Engineering and Management. Kitab Mahal, New Delhi.
2. A.W. Farrall. Engineering for Dairy and Food Products; Robery, E. Krieger Publishers Company, New York.
3. R.T. Toledo. (1997). Fundamentals of Food Process Engineering. 2nd ed. CBS Publishers, New Delhi

ME 323 (AE) COMPUTER AIDED DESIGN AND MANUFACTURING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Design process, application of computers for design, definition of CAD, benefits of CAD. CAD system components. Computer hardware for CAD. Display, input and output devices.
Introduction to optimisation methods in design. Classical optimization techniques, maxima-minima etc. Optimal design of elements and systems. Role of optimisation techniques and finite element method in CAD. (Introductory treatment only)

Unit-II

Computer Graphics: Graphics primitives, display file, frame buffer, display control, display processors. Line generation, graphics software. Points and lines, DDA and Bresenham's line algorithms, antialiasing lines. Polygons, filling of polygons. Bresenham's algorithm for

drawing circle and ellipse. Text primitive. Other primitives. Windowing and clipping, viewport. Homogeneous coordinates. Transformations.

Unit-III

Introduction to numerical control, basic components of NC system, NC coordinates and motion control systems. Computer numerical control, direct numerical control, combined CNC/DNC.

Unit-IV

NC machine tools and control units. Tooling for NC machines, Part programming, punched tape, tape coding and format, manual and computer assisted part programming.

Practicals: Two dimensional drafting exercises on AutoCAD or similar software, including dimensioning. Demonstration of CNC machine.

Texts/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.

FE 324 TRACTOR SYSTEMS AND CONTROLS

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Study of transmission system: Clutch:single and multiple clutches and their functions, gear box: sliding and constant mesh, differential and final drive mechanism. Simple numerical problems on clutch and gear 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.

Practicals

1. Introduction to transmission systems and components.
2. Study of clutch system.
3. Study of different types of gear box and calculation of speed ratios.
4. Study on differential and final drive of a tractor.
5. Study of brake system of a tractor.
6. Study of hydraulic system in a tractor.
7. Study of traction performance of a tractor wheel.
8. Anthropometric measurements of a farm worker.
9. Measurement of physiological cost of tractor operator during farm operation.
10. Study of advances in tractor systems and controls.

Text Books\References

1. B.J. Liljedahl, P.K. Turnquist, W.D. Smith and Hoki Vaketo. (1989). Tractor and their Power units. Jhon Wiley & Sons., New York.
2. F.R. Jones. 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.

FE 325 FIELD OPERATION AND MAINTENANCE OF FARM MACHINERY

Cr. Hrs. 2 (0 + 2)

	L	T	P
Credit	**0**	**0**	**2**
Hours	**0**	**0**	**4**

Practicals

1. Adjustment and maintenance of primary and secondary tillage equipment viz. M.B. plough, disc-plough and disc harrow.
2. Study and practising the hitching and dehitching of implements.
3. Field operation and field adjustments of m.b. plough and disk plough.
4. Field operation of disk harrow.
5. Adjustment and maintenance of seeding and planting machines.
6. Field operation and adjustments of seed drill/planter.
7. Adjustment and maintenance of plant protection equipment.
8. Adjustment and maintenance of reapers and threshers.
9. Adjustment and maintenance of combine harvesters and straw combines.
10. Visit to small scale farm machinery manufacturers and their repair shops, seasonal repair of farm machinery.

Text Books/References

1. Jacobs. Co. and R.H. William. Agricultural power and machinery, Mc-Garw Hill Book Company
2. Service manuals of various agricultural machinery.

SW 326 IRRIGATION ENGINEERING

Cr. Hrs. 4 (3 + 1)

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

Unit-I

Irrigation Engineering: Irrigation, impact of irrigation on Human Environment, some major and medium irrigation schemes of India, purpose of irrigation, sources of irrigation water, present status of development and utilization of different water resources of the country.

Unit-II

Measurement of irrigation water, weir, notches, flumes and orifices and other methods; water conveyance, design of irrigation field channels, underground pipe conveyance system, irrigation structures, channel lining.

Unit-III

Soil water plant relationship, soil water movement, infiltration, evapo-transpiration, soil moisture constants, depth of irrigation, frequency of irrigation, irrigation efficiencies.

Unit-IV

Surface irrigation methods of water application, border, check basin, furrow irrigation; sprinkler and drip irrigation method, merits, demerits, selection and design; Participatory irrigation management. Economics of water resources utilization.

Practicals

1. Measurement of soil moisture by different soil moisture measuring instruments.
2. Measurement of irrigation water.
3. Measurement of infiltration rate.
4. Computation of evaporation and transpiration.
5. Design of under ground pipe line system.
6. Infiltration-advance in border irrigation.
7. Measurement of advance and recession in border irrigation and estimation of irrigation efficiency.
8. Measurement of advance and recession in furrow irrigation and estimation of irrigation efficiency.
9. Measurement of uniformity coefficient of sprinkler irrigation method.
10. Measurement of uniformity coefficient of drip irrigation method.
11. Field problems and remedial measures for sprinkler and drip irrigation method.

Text Books/References

1. A.M. Michael. (1978). Irrigation Theory and Practice, Vikas Publishing House Pvt. Ltd., New Delhi.
2. R. Lal and A.C. Datta. (1971). Agricultural Engineering through worked examples, Saroj Prakashan, Allahabad
3. V.V.N. Murty. (1985). Land and Water Management Engineering, Kalyani Publishers, New Delhi.
4. R.K. Sharma. (1984). Text book of Irrigation Engineering and Hydraulic Structures, oxford & IBH Publishing CO. New Delhi.

SW 327 DRAINAGE ENGINEERING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Drainage, objectives of drainage, familiarization with the drainage problems of the state, Surface drainage, drainage coefficient, types of surface drainage, sub-surface drainage purpose and benefits of drainage.

Unit-II

Design of open channel, investigations of design parameters, hydraulic conductivity, drainable porosity, water table etc., types and use of subsurface drainage system.

Unit-III

Design of sub-surface drainage system, interceptor and relief drains. Derivation of ellipse (Hooghoudt's) and Ernst's drain spacing equations. types of sub-surface drainage system.

Unit-IV

Drainage materials, drainage pipes, drain envelope. Layout, construction and installation of drains. Drainage structures. Vertical drainage. Bio-drainage. Tile Drains. Drainage of irrigated and humid areas. Salt balance, reclamation of saline and alkaline soils. Leaching requirements, conjunctive use of fresh and saline waters. Economic aspects of drainage.

Practicals

1. In-situ measurement of hydraulic conductivity.
2. Determination of drainage coefficients.
3. Installation of piezometer and observation well.
4. Preparation of iso-bath and iso-bar maps.
5. Measurement of hydraulic conductivity and drainable porosity.
6. Design of surface drainage systems.
7. Design of subsurface drainage systems.
8. Determination of chemical properties of soil and water.
9. Fabrication of drainage tiles.
10. Testing of drainage tiles.
11. Determination of gypsum requirement for land reclamation.
12. Installation of sub-surface drainage system.
13. Cost analysis of surface and sub-surface drainage system.

Text Books/References

1. H.M. Ritzema, (Editor in Chief). (1994). Drainage Principles and Applications (2nd edition), International Institute of Land Reclamation and Improvement, Post Box-45, Wageningen. The Netherlands.
2. Luthin, James N. (Editor) (1957). Drainage of Agricultural Lands, Agronomy Monograph No. 17, American Society of Agronomy, USA.
3. A.M. Michael and T.P. Ojha. Principles of Agricultural Engineering, Vol. II, Jain Publication, New Delhi.

EC 328 (AE) MICROPROCESSOR AND LOGIC CIRCUITS

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Computer Number Systems and Codes: Number Systen and their conversion, Negative Numbers representation, Binary Coded Decimal number, Excess-3 BCD Code, Gray Codes representation.

Logical Operation, Logic Gates and Boolean Algebra: Truth Table, Logical Operation and logic gates, Logic Circuit, Realizing Circuits From Boolean Expressions, Derived Logical Functions and Gates: The NAND Gate, The NOR Gate, The Exclusive - OR or XOR Gate, The Exclusive-NOR, or XNOR Gate, Boolean Algebra, Bolean Algebra Theorems, De Morgan's Therorems, Duality Theorem, Universal Gates.

Unit-II

Principles of Combinational Logic Circuits: Minterm and Maxterm designations, Canonical Forms, Karnaugh Map: Karnaugh Map upto 4 variables, Simplification of Boolean expressions using K-map in POS and SOP form, Incompletely Specified Functions (Don't Care Terms). *Aritmetic Circuit:* Adders, Subtractor, Digital comparator, Decoders, Encoders, Multiplexers.

Unit-III

Sequential Logic Circuits: Latches, Filp-flops: SR(Set-Reset) Flip-Flop, Edge-Deterctor Circuits, Master-Slave S-R Flip-Flop, J-K flip-flop, Master-Slave J=K Flip-flop, D Flip-Flop, T Flip-flop. Introduction to Register.

Unit-IV

Microprocessor: Introduction to Microprocessor, Basic Concepts of 4-8-16-32-64 bit µp's. Evolution of Microprocessors. Internal architecture and pin configuration of 8085A, Interrupt system of 8085A, Instruction Set of the 8085, Addressing modes of 8085A. Simple Assembly language programming of 8085A.

Interfacing Memory and I/O Devices: Address space partitioning; Address map; Address decoding, Memory mapped I/O scheme, I/O mapped I/O scheme. Memory interfacing, Data transfer schemes, Interrupts of 8085, Multiple Interrupts; Direct Memory Access. Application of microprocessors in Agriculture Engineering.

Practicals: As per theory

Text Books/References

1. R.S. Gaonkar. (1995). Microprocessor Architecture, Programming and applications with the 8085/8080A, Wiley Eastern Ltd., 2nd ed, Up date.
2. Aditya P. Mathur. (1999). Introduction to Microprocessor, 3rd ed., Tata McGraw, Hill Publishing Company Limited, New Delhi.
3. Dharm Singh. (2004). Introduction to Digital Logic Design, Yash Publishing House, Bikaner.

FOURTH YEAR B.E. (VII SEMESTER)

PF 411 FOOD PACKAGING TECHNOLOGY

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Significance of packaging, Spoilage mechanism during storage: environmental conditions favoring microbial growth, moisture sorption isotherm and water activity of foods; Food Packaging: definition, functions, importance and scope of packaging of foods, types and classification of packaging.

Unit-II

Packaging forms; Packaging materials: Plastic films, paper and papers boards, types and characteristics of papers, metal containers, feature of metal containers, three piece can, soldered side can, welded side can, two piece can. aluminum, advantages and disadvantages of aluminum.

Unit-III

Glass containers, properties of glass, types of glasses and glass containers, properties of glass containers; Printing processes: Letter press, offset, litho and gravure printing.

Unit-IV

Disposal methods of waste packaging materials; Vacuum and gas packaging-process and machines, packaging materials, gas barriers property, water vapor barrier property, applications in some foods; Active packaging, Estimation of shelf life of packaged foods.

Practicals

1. Identification of different types of packaging materials.
2. Determination of tensile strength of given material.
3. Determination of compressive strength of given package.
4. To perform different destructive tests for glass containers.
5. To perform non-destructive tests for glass containers.
6. Vacuum packaging of agricultural produces.
7. Determination of tearing strength of paper board.

8. Measurement of thickness of packaging materials.
9. To perform grease-resistance test in plastic pouches.
10. Determination of bursting strength of packaging material.
11. Determination of water-vapour transmission rate.
12. Shrink wrapping of various horticultural produce.
13. Testing of chemical resistance of packaging materials.
14. Determination of drop test of food package.
15. Visit to relevant industries.

Text Books/References

1. Takashi Kodoya. Food Packaging Academic Press, Inc.
2. R. C. Griffin, and S. Sacharow. Principles of Package Development The AVI Publishing Company, Westport, Connecticut.

PF 412 DEVELOPMENT OF PROCESSED PRODUCTS

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Introduction to various processed products, value addition to rice, characteristics of structural materials, basic requirements for paddy grain storage, various methods for paddy storage, pretreatments to paddy grains and its basic concepts

Unit-II

Introduction to oil milling, traditional methods for oil milling such as village Ghanis, mechanical oil expeller, pretreatments for oil milling, various methods of oil milling for mustard, groundnut, AGMARK and I.S. standards.

Unit-III

Introduction to processing of various spices, processing of turmeric, processing of ginger, processing of cumin, processing of chilli, processing of coriander, processing of fenugreek, and processing of tamarind.

Unit-IV

Extrusion of foods – rheological properties of foods and operating characteristics, equipments, cold extrusion, extrusion cooking, effect on foods; Frying of foods-shallow and deep fat frying, equipments, effect on foods quality, Fermentation of foods- principles of fermentation, types of fermentors, equipments, quality of fermented foods.

Practicals

1. Study of Engleberg huller.
2. Study of single action drum cleaner.
3. Study of graders used in agro processing industries.
4. Study of paddy destoner.
5. Study of compact modern rice mill
6. Study of KVIC Ghani.
7. Study of mechanical oil expeller
8. Visit to Krishi Upaj Mandi.
9. Study of pin disc mill for spices.
10. Study of parboiling.
11. Visit to spice's processing industry.
12. Study of chilli milling.
13. Study of turmeric milling.
14. Study of coriander processing.

Text Books/References

1. E.V. Araulo, D.B. Padua and M. Rice Graham. Post Harvest Technology.
2. A. Chakravorty & D.E. De. (1998). Post Harvest Technology of Cereal and Pulses. Oxford & ISH Publishing Co. Pvt. Ltd., New Delhi.
3. P. Fellows. Food Processing Technology, Woodhead Publishing Limited.

PF 413 FOOD PROCESSING PLANT DESIGN & LAYOUT

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Introduction to plant design: Types of manufacturing processes, phases of plant design.
Plant location: levels of location problems, influence of location, location factors, plant site selection.

Unit-II

Industrial Buildings and grounds: Industrial buildings, building design and construction viz. floors, walls and windows, roof and ceilings; grounds and exterior facilities viz. Access highways and parking, rail access, access by water, landscaping, security, disaster protection.

Unit-III

Preparation of plant layout: layout problems, classes of layout problems, objectives, types of layout, optimization for plant layout, trends in plant layout, space requirement.

Development of the layout: Developing the plot plan, constructing the detailed layout, layout installation.

Unit-IV

Selection of processes, plant capacity, project design, flow diagrams, selection of equipments, process and controls

Material Handling: Importance, Kinds of conveyor systems, Plant layout for material handling, efficient use of material handling equipment, maintenance. Sanitary features of food processing plant.

Practicals

1. Planning, visit and layout of flour milling plant;
2. Planning, visit and layout of rice milling plant;
3. Planning, visit and layout of milk plant;
4. Planning, visit and layout of bakery plant;
5. Planning, visit and layout of fruits and vegetable dehydration plant;
6. Planning, visit and layout of beverages industry;
7. Planning, visit and layout of edible of extraction plant;
8. Planning, visit and layout of ice-cream plant;
9. Planning, visit and layout of sugar mill plant;
10. Planning, visit and layout of honey/turmeric/chillies processing plant.

Text Books/References

1. Chander, Lalat. (2004). Textbook of Dairy Plant Layout and Design. ICAR, New Delhi - 110012
2. A.W. Farallel. Food Engineering Systems. Vol 2-Utilities. AVI Publications.
3. J.M. Moore. Layout and Design. Macmillon Publishing Co., INC. New York.

PF 414 AGRICULTURAL STRUCTURES AND ENVIRONMENTAL CONTROL

Cr. Hrs. 3 (2 + 1)

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

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.

Practicals

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.

Text Books/Reference

1. Barre and Summet. Farm Structures.

PF 415 PRINCIPLES OF FOOD PRESERVATION

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Sources of foods, scope and benefits of industrial food preservation, perishable and non-perishable foods, causes of food spoilage

Food preservation methods- salt and sugar, principle and method, preservation by chemicals, antioxidants, mold inhibitors, acidulants; Fermentation preservation-definitions, advantages and disadvantages, types of fermentations, equipments.

Unit-II

Thermal processing method – canning process for foods, D Value and Z value for microorganisms and nutrients, TDT curve, evaluation of process effectiveness by graphical method; Blanching-theory, equipments, effect on food quality such as nutrients, colour, flavour and texture; Pasteurization – theory, equipments , effect on foods quality; Sterilization- in container sterilization, theory, retorting, UHT process, aseptic process, effect of food quality; Evaporation of foods- theory and principles, boiling point elevation, equipments, effect on foods.

Unit-III

Low temperature preservation: chilling of foods- theory, equipments, chill storage; Freezing- ice crystal formation, solute concentration, freezing time, equipments, effect on food quality; Freeze concentration- principles and process, problems due to precipitation of solids, food applications, equipments; membrane concentration-techniques, equipments used, effect on foods, hurdle technology.

Unit-IV

Drying of foods- mechanism of drying, process, types of dryers, physical and chemical effect on foods; Irradiation of foods- theory, measurement of doses, dose distribution, effect on microorganisms, effect on foods, applications physical, chemical and biological methods of detections of irradiated foods.; introduction to pulsed electrical field processing, dielectric and ohmic-heating of foods, high process processing.

Practicals

1. Demonstration of various machineries used in processing.
2. Demonstration of blanching of foods.
3. Preservation of food by high concentration of sugar i.e. preparation of jam.
4. Preservation of food by using salt- Pickle.
5. Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid.
6. Preservation of Bread, Cake using mold inhibitors.

7. Preservation of coconut shreds using humectants.
8. Drying of pineapple slices, apple slices in cabinet drier.
9. Demonstration on drying of green leafy vegetables.
10. Drying of Mango/other pulp by foam mat drying.
11. Demonstration of spray drying of a liquid food.
12. Drying of foods using freeze-drying process.
13. Demonstration of preserving foods by freezing process.

Text Books/References

1. P. Fellows. Food Processing Technology, Woodhead Publishing Limited, England.

PF 416 HORTICULTURAL CROP PROCESSING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Production and processing scenario of fruits and vegetable: India; Scope of Fruit and Vegetable Preservation Industry in India. Present status, constraints and prospectus. Overview of principles and preservation methods of fruits and Vegetables. Processing of Canned fruits and vegetables.

Unit-II

Preparation of Jam, Jelly and Marmalade of various fruits such as Guava, Grape, Aonla, Carrot and Citrus fruits. Preservation by heat treatment, addition of sugar, acids and flavour, boiling under vacuum, end point and storage. Extraction and Preservation of fruit juice and squash of the following fruits: Guava, Grape Aonla, Wood apple, Citrus fruits.

Unit-III

Preparation of candy of different types of fruits such as Citrus fruits, Aonla, Ginger, Papaya and Carrot. Processing technology for powder making of various fruits such as Aonla, Mango, Banana. Processing technology of vegetables for various products viz. Tomato: Ketchup, sauce, puree.

Unit-IV

Dried Leafy Vegetables viz. Spinach, Fenugreek, Coriander leaves, etc

Quality control: Food Laws and regulation in India, PFA Act, FPO Act, AGMARK, HACCP, ISO-2000, CAC (Codex Alimanterious, commission), BIS.

Practicals

1. Canning of Mango/Guava/Papaya.
2. Preparation of Fruit Jam: Guava,
3. Preparation of fruit Jelly
4. Preparation of fruit marmalade.
5. Preparation of fruit squash (Lemon)
6. Preparation of fruit RTS
7. Preparation of fruit syrup.
8. Preparation of grape raisin, dried fig and dried banana.
9. Preparation of pickle
10. Preparation of dried ginger
11. Preparation of dried onion/ garlic,.
12. Preparation of Potato wafers.
13. Dehydrated leafy vegetable.

Text Books/References

1. Girdhari Lal, G S Siddappaand, G L. Tandon. Preservation of fruits and vegetables. Publication ICAR, New Delhi - 110012.
2. W.V. Cruess. Commercial Fruit and Vegetable Products, Agrobios (India).

SW 411 MICRO IRRIGATION SYSTEMS DESIGN

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Past, present and future need of micro-irrigation systems, Role of Govt. for the promotion of micro-irrigation in India, Merits and demerits of micro-irrigation system, Types and components of micro-irrigation system,

Unit-II

Micro-irrigation system- design, design synthesis, installation, and maintenance. Sprinkler irrigation - types, planning factors, uniformity and efficiency, laying pipeline, hydraulic lateral, sub-mains and main line design, pump and power unit selection.

Unit-III

Drip irrigation – potential, automation, crops suitability. Fertigation – Fertilizer application criteria, suitability of fertilizer compounds, fertilizer mixing, injection duration, rate and frequency, capacity of fertilizer tank. Quality control in micro-irrigation components,

Unit-IV

Design and maintenance of polyhouse; prospects, waste land development – hills, semi-arid, coastal areas, water scarce areas, Benefit and Cost analysis.

Practicals

1. Study of different types of micro-irrigation systems and components.
2. Field visit of micro-irrigation system.
3. Study of water filtration unit.
4. Discharge measurement study of different micro-irrigation systems.
5. Study of water distribution and uniformity coefficient.
6. Study of wetted front and moisture distribution under various sources of micro-irrigation system.
7. Design of micro-irrigation system for an orchard.
8. Design of micro-irrigation system for row crops design of spray type micro-irrigation system.
9. Design of micro-irrigation system for hilly terraced land.
10. Study of automation in micro-irrigation system.
11. Study of micro climate inside a Polyhouse.
12. Study of maintenance and cleaning of different components of various systems.
13. Design of sprinkler irrigation system.
14. Design of landscape irrigation system

Text Books/References

1. A.M. Michael. (1978). Irrigation Theory and Practice, Vikas Publishing House Pvt. Ltd., New Delhi.
2. R. Lal and A.C. Datta. (1971). Agricultural Engineering through worked examples, Saroj Prakashan, Allahabad
3. V.V.N. Murty. (1985). Land and Water Management Engineering, Kalyani Publishers, New Delhi.
4. R.K. Sharma. (1984). Text book of Irrigation Engineering and Hydraulic Structures, oxford & IBH Publishing CO. New Delhi.
5. B.C. Punmia and B.L. Pande (1983). Irrigation and Water Power Engineering, Standard Publishers Distributors, Delhi.
6. R. S. Varshney, S. C. Gupta and R. L. Gupta. (1979). Theory and Design of Irrigation Structures Vol. II, Nem Chand & Bros. Roorkee.

SW 412 WATERSHED PLANNING AND MANAGEMENT

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Watershed management - problems and prospects; watershed based land use planning, watershed characteristics – physical and geomorphologic, factors affecting watershed management, hydrologic data for watershed planning, watershed delineation, delineation of priority watershed.

Unit-II

Water yield assessment and measurement from a watershed; hydrologic and hydraulic design of earthen embankments and diversion structures; sediment yield estimation and measurement from a watershed and sediment yield models.

Unit-III

Rainwater conservation technologies - in-situ and storage, design of water harvesting tanks and ponds; water budgeting in a watershed; effect of cropping system, land management and cultural practices on watershed hydrology.

Unit-IV

Evaluation and monitoring of watershed programmes; people's participation in watershed management programmes; planning and formulation of project proposal; cost benefits analysis of watershed programmes; optimal land use models; case studies.

Practicals

1. Study of watershed characteristic.
2. analysis of hydrologic data for watershed management.
3. Delineation of watershed and measurement of area under different vegetative and topographic conditions.
4. Measurement of water and sediment yield from watershed.
5. Study of different watershed management structures.
6. Study of various water budget parameters.
7. Study of watershed management technologies.
8. Preparation of a techno-economically effective project proposal.

Text Books/References

1. Ghanshyam Das. (2000). Hydrology and Soil Conservation Engineering. Prentice Hall of India, New Delhi.
2. K. Subramanya. (1993). Engineering Hydrology, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. R.K. Linsley, M.A. Kohler and J.L.H. Paulhus. (1983). Hydrology for Engineers, McGraw Hill International Book Company, London.
4. H.M. Raghunath. (1988). Hydrology, Wiley Eastern Ltd,, New Delhi.
5. Ullah, Wasi, S.K. Gupta and S.S. Dalal. (1972). Hydrological Measurements for Watershed Research, Jugal Kishore and Co., Dehradun.
6. P.K. Singh. (2000). Watershed Mangement (Design and Practice), e-media publications, Udaipur.
7. R. Suresh. (2002). Soil and Water Conservation Engineering, Fourth Edition Standard Publishers and Distributors, Delhi.
8. Raj Vir Singh. (2003). Watershed Planning and Management, Second Edition, Yash Publishing, Bikaner.

SW 413 MINOR IRRIGATION AND COMMAND AREA DEVELOPMENT

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Major, medium and minor irrigation projects – their comparative performance; development and utilization of water resources through different minor irrigation schemes.

Unit-II

Basic concepts of command area – definition, need, scope, and development approaches: historical perspective, command area development authorities.

Unit-III

Interaction/collaboration of irrigation water use efficiency and agricultural production. Planning and execution of on farm development activities within the scope of command area development.

Unit-IV

Use of remote sensing techniques for command area development; case studies of some selected commands; Farmers participation in command area development.

Practicals

1. Topographic survey and preparation of contour map.
2. Preparation of command area development layout plan.
3. Land leveling design for a field.
4. Earthwork and cost estimation.
5. Irrigation water requirement of crops.
6. Preparation of irrigation schedules.
7. Planning and layout of water conveyance system.
8. Design of Irrigation systems.
9. Conjunctive water use planning.
10. Application of remote sensing for command area development.
11. Technical Feasibility and economic viability of a command area project.
12. Study tour to minor irrigation and command area development projects.

Text Books/References

1. A.M. Michael. (1978). Irrigation Theory and Practice, Vikas Publishing House Pvt. Ltd., New Delhi.
2. R. Lal and A.C. Datta. (1971). Agricultural Engineering through worked examples, Saroj Prakashan, Allahabad
3. V.V.N. Murty. (1985). Land and Water Management Engineering, Kalyani Publishers, New Delhi.
4. R.K. Sharma. (1984). Text book of Irrigation Engineering and Hydraulic Structures, oxford & IBH Publishing CO. New Delhi.
5. S.R. Sahasarbudha. (1978). Irrigation Engineering and Hydraulic Structures, Katson Publishing House, Ludhiana.
6. B.C. Punmia and B.L. Pande. (1983). Irrigation and Water Power Engineering, Standard Publishers Distributors, Delhi.

SW 414 GULLEY AND RAVINE CONTROL STRUCTURES

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Introduction; 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.

Unit-III

Flood control - history of flood control, structural and non-structural methods of flood control measures, storage and detention reservoirs, levees, channel improvement.

Unit-IV

Gulley erosion and its control; soil erosion and sediment control measures; river training works, planning of flood control projects and their economics.

Practicals

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 frequency distribution functions for extreme flood values using log-Pearson Type-III distribution.
5. Determination of confidence limits of the flood peak estimates for Gumbel's extreme value distribution.
6. Determination of probable maximum flood.
7. Standard project flood and spillway design flood.
8. Design of levees for flood control.
9. Design of jetties.
10. Study of vegetative and structural measures for Gulley stabilization.
11. Designing and planning of a flood control project.
12. Cost and benefit analysis of a flood control project.

Text Books/References

1. R.V. Singh. (2003). Watershed Planning and Management, Second Edition Yash Publishing House, Bikaner. P. 624.
2. P.K. Singh. (2000). Watershed Management (Design and Practices), e-media Publication, Udaipur. P. 174.
3. V.V.N. Murty. (1985). Land and Water Management Engineering, Second Edition Kalyani Publisher, Ludhiana. P.586.
4. R. Suresh. (2002). Soil and Water Conservation Engineering, Fourth Edition Standard Publishers and Distributors, Delhi.
5. Ullah, Wasi, S.K. Gupta and S.S. Dalal. (1972). Hydrological Measurements for Watershed Research, Jugal Kishore and Co., Dehradun.

SW 415 REMOTE SENSING AND GIS APPLICATION

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Remote Sensing: Definition, stages in remote sensing, modern remote sensing technology versus conventional aerial photography; basic principles of image interpretation, factors governing the quality of an image; factors governing interpretability, visibility of objects, elements of image interpretation.

Unit-II

Techniques of image interpretation, visual image interpretation, digital image processing, digital image; remote sensing in agriculture progress and prospects, microwave radiometry for monitoring agriculture crops and hydrologic forecasting; aerial photo interpretation for water resources development and soil conservation survey.

Unit-III

GIS: History of development of GIS, definition, basic components, and standard GIS packages; data-entry, storage and maintenance; data types-spatial-non-spatial (attribute data), data structure.

Unit-IV

Data format- point line vector-raster – polygon-object structural model, files, files organization-data base management systems (DBMS), entering data in computer-digitizer-scanner-data compression.

Practicals

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

Text Books/References

1. M.A. Reddy. (2002). Remote Sensing and Geographical Information Systems. Second Edition, B.S. Publication, Hyderabad.
2. Lillsand and Kiefer. Remote Sensing and Image Interpritation, John Weiley & Sons.
3. P.A.Longley, M.F. Good Child, D.J. Maguire and D.W. Rhind. Geographic Information. System and Science, John Wiley & Sons Ltd., New York.

SW 416 RESERVOIR AND FARM POND DESIGN

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Earthen embankments - functions, advantages and disadvantages, classification - hydraulic fill and rock fill dams - homogeneous, zoned and diaphragm type; foundation requirements, grouting.

Unit-II

Seepage through dams - estimation of seepage discharge, location of seepage/phreatic line by graphical and analytical methods, flow-net and its properties, seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes.

Unit-III

Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc.

Unit-IV

Stability of slopes - analysis of failure by slice method; types of reservoirs and farm ponds, design and estimation of earth work; cost analysis.

Practicals

1. Study of different types and materials of earthen dams.
2. Determination of the position of phreatic line in earth dams for various conditions.
3. Stability analysis of earthen dams against head water pressure.
4. Stability analysis of earthen dams against foundation shear.
5. Stability analysis of earth dams against sudden draw down condition.
6. Stability of slopes of earth dams by friction circle method / different methods.
7. Construction of flow net for isotropic and anisotropic medium.
8. Computation of seepage by different methods.
9. Determination of settlement of earth dam.
10. Input-output-storage relationships by reservoir routing.
11. Design of farm ponds.
12. Cost estimation of farm ponds and other structures.

Text Books/References

1. Ghanshyam Das. (2000). Hydrology and Soil Conservation Engineering. Prentice Hall of India, New Delhi.
2. R. Suresh. (2002). Soil and Water Conservation Engineering, Fourth Edition, Standard Publishers and Distributors, Delhi.
3. Raj Vir Singh. (2003). Watershed Planning and Management, Second Edition, Yash Publishing, Bikaner.
4. P.K. Singh. (2000). Watershed Management (Design and Practice), e-media publications, Udaipur.

SW417 GROUND WATER RECHARGE TECHNOLOGY

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Concept of artificial recharging.
Basic Phenomena of ground water recharge, selection of site and identification of recharge structures, Natural recharging.

Unit-II

Artificial recharge structures, Direct surface technique– Flooding, Basin or Stream augmentation, Ditch & furrow method, Over irrigation. Direct sub surface technique – Injection well, Recharge pit and shaft, Dug well recharge, Sub surface dykes.

Unit-III

Roof top rain water harvesting – Design of filter and estimation of size of pipe, runoff potential and size of tank.

Unit-IV

Design criteria of recharge structures, Design and cost estimation of recharge structures, use of RS & GIS for identification of potential artificial recharge Zones.

Practicals:

1. Analysis of rainfall for estimation of probability of occurrence of rainfall.
2. Estimation of surface runoff from various surfaces e.g. RCC floring, barren land Katchha roof, cultivated land etc. (Soil cover complex method).
3. Estimation of quantity of available water for rain water harvesting based of the area, topography and condition of the site.
4. Design of the rooftop rain water harvesting structure
5. Design of rain water harvesting of road and kutchha flooring.
6. Design of subsurface rainwater harvesting at river bed.
7. Design of the injection well harvesting structure
8. Study of the various types of filters for rainwater harvesting
7. Estimation of the materials for the rainwater harvesting structure
8. Testing of the material used for rainwater harvesting
9. Case studies of the existing rainwater harvesting structures.

Suggested readings:

1. Todd D.K. (2004), Ground water hydrology, second edition. John Wiley & sons New York.
2. Jat M.L. and S.R. Bhakar (2009), Ground water hydrology, Agrotech publishing academy Udaipur.

FM 411 TRACTOR DESIGN AND TESTING

Cr. Hrs. 3 (2 + 1)

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

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.

FM 412 HYDRAULIC DRIVES AND CONTROLS

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Hydraulic Basics: Pascal's Law, Flow, Energy, Work, and Power. Hydraulic Systems, Color Coding, Reservoirs, Strainers and Filters, Filtering Material and Elements. Fluid properties.

Unit-II

Pumps: Pump Classifications, Performance, Displacement, Designs, Gear Pumps, Vane Pumps, Piston Pumps, Pump Operation. Hydraulic Actuators, Cylinders-displacement, Construction and Applications, Semi rotary actuators.

Unit-III

Hydraulic Motors and circuits. Accumulators: Types and working. Hydraulic Circuit, Fittings and Connectors. Hydraulic valves: Pressure-Control Valves, Directional-Control Valves, Flow-Control Valves, Valve Failures and Remedies, Valve Assembly.

Unit-IV

Hydraulic Circuit Diagrams and Troubleshooting. United States of American Standards Institute USASI and JIC Symbols. Tractor hydraulics, nudging system, ADDC. Use of Hydraulics and Pneumatics drives in agricultural systems. Open centre and close centre hydraulic systems.

Practicals

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. Hydraulic codes and circuits.
7. Building simple Hydraulic Circuits.
8. Hydraulics in Tractors.
9. Pneumatics in Agriculture.

Text Books/References

1. B.J. Lilijedahl, P.K. Turanquist, W.D. Smith and Hok: Makoto. (1989). Tractors and their power unity. AG publication, forth edition, New York.
2. J.P. Michael and G.A. John. (1989). Power Hydraulics, Prenlice Hall, New York.
3. Fundamentals of service 'FOS', Hydraulics, John deere and company, Moline.
4. Kirpal Singh. Automobile Engineering Part I, Standard Publishing Distributors, Delhi.

FM 413 FARM POWER AND MACHINERY MANAGEMENT

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Farm Mechanization: Objectives and myths. The role of mechanization and its relationship to productivity, employment, social and technological change.

Unit-II

Agricultural Machines Capacities: Rates of work, Field efficiency and factors affecting it, Calculations of machine capacities and field efficiency for different field conditions and machines.

Unit-III

Selection of machinery from a capacity standpoint; Estimating power and fuel requirements, Selecting tractors and implements from power requirement standpoint; Selection of optimum width of machinery, timeliness of operation.

Unit-IV

Cost analysis of machinery: fixed cost and variable costs; Replacement of farm machine; mechanization planning; case studies of agricultural mechanization in India.

Practicals

1. Solving problems related to various capacities, pattern efficiency, system limitation, power requirement and other operational parameters.
2. Solving of problems related to cost analysis.
3. Solving problems related to selection of equipment and replacement.
4. Presentation of seminar on topic assigned related to farm machinery management.
5. Design of farm mechanization plan for different farm size and cropping pattern.

Text Books/References

1. Hunt, D, Farm Power and Machinery Management, Lows State University Press, USA, 1979
2. Culpin, C, Profitable farm Mechanization, Lock Wood & Sons, London, 1996
3. Bainer, R. Barger, E.L. and R.A. Kepner 1997. Principles of Farm Machinery. John Wiley & Sons, Inc, New York,
4. Shrivastava A.C. et al. Principle of Farm Machinery ASAE publications.

FM 414 HUMAN ENGINEERING AND SAFETY

Cr. Hrs. 3 (2 + 1)

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

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

Measurement of energy, direct and indirect methods. Energy cost of different activities and Acceptable work load. Noise and vibration, its measurement and control.

Unit-III

Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance.

Unit-IV

Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

Practicals

1. Calibration of the subject in the laboratory using bi-cycle Ergometer as loading device versus different physiological parameters.
2. Calibration of the subject in the laboratory using mechanical treadmill as loading device versus different physiological parameters.
3. Study of Respiration gas meter and its use in selected farm operation and their comparison from energy point of view.
4. Calibration of the subject using Heart Rate Monitor in farm operation.
5. Study of general fatigue of the subject using Blink ratio method.
6. Anthropometric measurements of a selected group of farm workers and its statistical analysis.
7. Study of optimum work space layout and locations of controls of different factors. Familiarization with the noise and vibration equipment.

Text Books/References

1. P.O. Astrant and K. Rodhal. (1970). A Test Book of Work Physiology. McGraw Hill Book Co., New York.
2. E.J. Mc Cormic. (1979). Human Factors in Engineering Design. Tata McGraw Hill Pub., Co., New Delhi.
3. J.A. Roebuchk. K.H.E. Kroenor and M.S. Thomson. Engineering Anthropometry, John Willey & Sons, New Delhi.

FM 415 MECHANICS OF TILLAGE AND TRACTION

Cr. Hrs. 3 (2 + 1)

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

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.

FM 416 LAND DEVELOPMENT AND GRADING

Cr. Hrs. 3 (3 + 0)

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

Unit-I

Land leveling-Criteria for land leveling, plane profile, plane inspection and contour adjustment methods, land leveling design problems related to land leveling design and earth work calculation.

Engineering fundamentals related to earth-moving machinery.

Unit-II

Earth moving and excavation machines classification and application of bulldozers, advantage and disadvantage, straight and angle bulldozers, moving earth with bulldozers and estimation of output of a bulldozer numerical problems.

Land clearing equipments, Power shovel: Construction and operation of power shovel size selection of power shovel factors affecting the output of a power shovel.

Unit-III

Scraper: Types, construction and operation of scrapers, size of the scraper, cycle time production rates of scrapers, numerical problems, load-growth curve and estimation of output of a scraper.

Dragline: Types of dragline, size basic parts and operation of a dragline, output of a dragline, estimation of output, effect of different factors on output, numerical problems.

Clam shell: Basic parts and operation of a clam shell, application, size and output of a clam shell.

Motor grader: Construction and operation of motor grader, application, basic adjustment parameters of major grader, output of motor grader,

Unit-IV

Trenching machines: types, construction and operation of wheel and ladder type trenching machines, selection of suitable equipment for excavating trenches and production rates of trenching machines.

Compactors: Properties-swell and shrinkage type of compacting equipment and construction details.

Job planning and management: Project network analysis, definitions of terms used in critical path method (CPM), critical path scheduling, AOA diagram, computerized scheduling.

Text Books/References

1. R.L. Peurifoy. Construction, Planning, Equipment and Methods.
2. Mahesh Verma. Construction equipment and its planning and application.
3. Jagman Singh. Heavy construction, planning, equipment and methods.
4. A.M. Michael. Irrigation theory and practices.

FM 417 PESTICIDES APPLICATION AND EQUIPMENT

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Fundamentals of Pesticide application, Sprayers- manually and power operated – types-construction operations, calibration, Introduction to electrostatic and ULV sprayers.

Unit-II

Air assisted sprayers, High clearing sprayers, Dusters: manually and power operated – types-construction, operation, calibration.

Unit-III

Atomizing devices, nozzles, types, flow rates, spray angles, droplet size, agitations of spray material, Arial spray application- Limitation and advances, air crafts spraying and dusting equipment. Measurement of efficiency of pesticide application- collection and measurement of droplets- determination of vmd.

Unit-IV

Factors for selection of sprayer/duster and planning pesticide application. Safety in pesticide application- selection of pesticide – storage and handling of protective devices.

Practicals

1. Study of various types of nozzles
2. Study of manually operated sprayers.
3. Study of power operated sprayers.
4. Study of manually operated dusters.
5. Study of power operated dusters.
6. Calibration of sprayers.
7. Calibration of dusters.
8. Testing of different types of nozzles.

Text Books/References

1. R. Bainer, E.L. Barger and R.A. Kepner. (1979). Principles of Farm Machinery. John Wiley & Sons, Inc, New York.
2. H. Singh and O.S. Bindra. (1980). Pesticides and Application Equipment, Oxford & IBM Publication Co.
3. P.R. Mathew. Pesticides Application and Equipment.

RS 411 RENEWABLE POWER SOURCES

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization

Unit-II

Biogas technology and mechanisms, generation of power from biogas, Power generation from urban, municipal and industrial waste

Unit-III

Solar thermal and Photovoltaic. System for power generation. Central receiver (Chimney) type solar plant, OTEC, MHD, hydrogen and fuel cell technology.

Unit-IV

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

Practicals

1. Performance evaluation of solar water heater.
2. Performance evaluation of solar cooker.
3. Characteristics of solar photovoltaic panel.
4. 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.

Text Books/References

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

RS 412 GREENHOUSE TECHNOLOGY

Cr. Hrs. 3 (2 + 1)

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

Unit-I

History and types of greenhouse; importance, function and features of green house; scope and development of green house technology, applications of greenhouse.

Unit-II

Location, Planning and various components of greenhouse; design criteria and calculation; constructional material and methods of construction; covering materials and its characteristics, instrumentation & computerized environmental Control Systems.

Unit-III

Solar heat transfer, solar fraction for green house, steady state analysis of greenhouse, Greenhouse heating, cooling, shedding and ventilation systems; Carbon Dioxide generation and monitoring and lighting systems, repair & maintenance of greenhouse.

Unit-IV

Watering, fertilization, root substrate and its pasteurization, containers and benches, plant nutrition. Alternative cropping systems; plant tissue culture, chemical growth regulation; disease control; integrated pest management; postproduction quality and handling, Cost analysis of greenhouse production.

Practicals

1. Study/visit to a functional green house.
2. Planning and layout of green house & associated utilities.
3. Material selection for the construction of greenhouse.
4. Measurement of temperature using thermomseter, thermistor & thermocouples inside the green house.
5. Measurement of humidity & air velocity using various methods.
6. Measurement of solar radiations inside the green hous.
7. Application of psychometric charts.
8. Estimation of cooling requirements in a green house.
9. Estimation of ventilation requirements.
10. Thermal performance of greenhouse.
11. Application of data loggers for simultaneous estimation & control of different parameters like temp., RH, solar radiations etc..
12. Calculations of environment indices inside a green house.
13. Structural analysis of greenhouse; Economic analysis of greenhouse.
14. Visit to a commercial greenhouse.

Text Books/Reference

1. S. Kothari, S.C. Kaushik and A.N. Mathur. (2006). Greenhouse, Science & Technology, Himanshu Publications, Udaipur.
2. N.S. Rathore, A.K. Kurchania, N.L. Panwar. (2007). Non Conventional Energy Sources, Himanshu Publications.
3. Pratap Singh et. al. (2004). Sustainable Development through Renewable Energy Sources Yash Publications, Bikaner.

RS 413 ENVIRONMENTAL ENGINEERING

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Importance of safe water supply system. Domestic water requirements for urban and rural areas. Sources of Water supply. Intakes and transportation of water.

Unit-II

Drinking water quality. Indian Standards of drinking water. Introduction to water treatment for safe drinking, Importance of sanitation.

Unit-III

Domestic waste water: quantity, characteristics, disposal in urban and rural areas. Sewer: types, design discharge and hydraulic design. Introduction to domestic wastewater treatment.

Unit-IV

Solid waste: quantity, characteristics and disposal for urban and rural areas. Introduction to air pollution. Types of pollutants, properties and their effects on living beings. BIS standards for pollutants in air and their abetments.

Practicals

1. Determination of turbidity.
2. pH of solution; Suspended solids.
3. Dissolved solids.
4. Total solids.
5. Temporary hardness.
6. Permanent hardness.
7. Fluorides.
8. Chlorides, dissolved oxygen.
9. BOD.
10. Collection of air samples and their analysis.
11. Numerical problems related to theory.
12. Visit to treatment plant.

Text Books/References

1. N.S. Rathore, A.K. Kurchania. (2006). Biomethanation Technology, Apex Publications, Udaipur.
2. H. Jhadav & V.M. Bhosale. Environmental Protection & Laws, Himalaya Pub. House, Delhi.
3. M.N. Rao and A. K. Datta. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
4. B.K. Sharma. Environmental Chemistry. Goel Publishing House, Meerut

RS 414 WASTE AND BY-PRODUCT UTILIZATION

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Types and formation of byproducts and waste; magnitude of waste generation in different agro- processing industries; concept scope and maintenance of waste management and effluent treatment, basics pf Waste Recycling & Resources Recovery System (WRRRS), Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues.

Unit-II

Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization.

Unit-III

Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting, Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste– trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons.

Unit-IV

Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste.

Practicals

1. Waste characterization: (a) temperature (b) pH (c) solids content (d) turbidity (e) BOD (f) COD; Determination of ash content of agril. Wastes.
2. Determination of unburnt carbon in ash of paddy straw.
3. To study about briquetting of agricultural residues.
4. Estimation of excess air for better combustion of briquettes.
5. To study about extraction of oil from rice bran.
6. To study about waste treatment plant in food industry.
7. To study about utilization of whey.
8. To study about recovery of peel oil.
9. To study about recovery of germ and germ oil from by-product of cereals.
10. Practical on bioconversion of agro-wastes.
11. Practical on recycling of agro-wastes and by-products.
12. Visits to various industries using waste and food by-products.

Text Books/References

1. O.P. Vimal. Energy from Biomass, Agricole Publishing Academy, New Delhi.
2. O.P. Vimal and M.S. Bhatt. Wood Energy System, Agricole, Pub. New Delhi.
3. N.S. Rathore, N.L. Panwar & S. Kothari. Biomass Production and Utilization Technology, Himanshu Pulications, Udaipur.
4. N.S. Rathore, A.K. Kurchania. N.L. Panwar. (2007). Non Conventional Energy Sources, Himanshu Publications.

RS 415 ENERGY MANAGEMENT

Cr. Hrs. 3 (3 +0)

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

Unit-I

Energy Basics; Energy Demand Management, Conservation & Resource Development, Energy for Sustainable Development.

Unit-II

Need for Energy Management by Sector- Industry, Buildings & Houses, Transport, Electric Power.

Unit-III

Need for Energy Management by Sector- Agriculture, Domestic; Energy forecasting techniques; Energy Integration, Energy Matrix.

Unit-IV

Energy Auditing; Energy management for cleaner production, application of renewable energy, appropriate technologies.

Text Books/References

1. Pradeep Chadurvedi. (2003). Energy Environment & Sustainable Development. Concept Publishing Company, New Delhi.
2. S. Fred Dubin and G. Chalmers Long. Energy Conservation Standards for Building Design. Mc Grow- Hill Book Company.
3. V.S. Mahajan. (1999). National Energy: Policy, Crisis & Growth. Ashish Publishing Company, New Delhi.
4. V.S. Mahajan, S.K. Agnihotri and R.P. Athparia. (1999). Energy & Energy Resource Management. Deep & Deep Publications Pvt. Ltd., Delhi.
5. B. Majumdar. (1999). A Text Book of Energy Technology. A.P.H. Publishing Cooperation, New Delhi.
6. N.S. Ranthore, A.N. Mathur and A.S. Solanki. (1993). Integrated Rural Energy Planning.
7. T.L. Shaw, D.E. Lennard and P.M.S. Jones. (1984). Policy and Development of Energy Resources. John Willey & Sons, Newyork.
8. Surendra Singh and J.P. Mittal. (1992). Energy in Production Agriculture. Mittal Publications, New Delhi.

BS 411 OPERATION RESEARCH

Cr. Hrs. 3 (3 + 0)

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

Unit-I

Introduction and importance of OR; Meaning and classification of models; Linear programming; Mathematical formulation, Graphical Solutions.

Unit-II

Simplex methods; Degeneracy and duality.

Unit-III

Transportation type problems, Assignment problems.

Unit-IV

Concepts of waiting line and simple problems, Project management by PERT/CPM methods.

Text Books/References

1. S.D. Sharma. (1980). Operations Research, Pragati Prakashan, Meerut.
2. Goyal and Mittal. (1982). Operations Research, Pragati Prakashan, Meerut.

ME 411 (AE) PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Metal Working: Drop forging, drop hammers, dies for drop forging, upset and press forging, forging presses, forging rolls, forging defects. Hot and cold extrusion. Seamless tubes manufacturing processes, swaging. Wire, bar and tube drawing.

Unit-II

Sheet Metal Working: Classification of processes. Process capabilities, process planning and elements of tooling of shearing (blanking, piercing, trimming, shaving, notching), drawing and forming processes. Sheet metal presses. Punch and die sets. Compound, progressive, and combination dies. Drop hammer forming, Guerin process, bulging, stretch forming, spinning and explosive forming. High velocity forming of metals.

Moulding and extrusion of plastic, forming and drawing of plastic sheets.

Unit-III

Powder Metallurgy: Introduction, production of powder, manufacturing of parts by powder metallurgy and their applications.

Production of screw threads, milling, and uses of dies. Production of gears, milling, shaping, and hobbing, finishing of gears.

Heat Treatment Processes: hardening, tempering, annealing, precipitation, and surface hardening.

Unit-IV

Abrasive Machining: Types and classification. Surface, cylindrical, and centreless grinding. Tool and cutter grinders. Grinding wheels, abrasives, bonding processes, selection of grinding wheels. Honing, lapping, and superfinishing methods, polishing and buffing.

Unconventional Machining Methods: Abrasive jet, electric discharge, electrochemical, ultrasonic, electron beam, plasma arc and laser beam machining. Electrolytic grinding, chemical milling.

Practicals

1. Demonstration/exercises related to forging and sheet metal working.
2. Exercises/study on screw threads and gear measurement, surface roughness measurement, comparators, etc.

Text Books/References

1. J.S. Campbell. Principles of Manufacturing Materials and Processes, Tata McGraw-Hill Company Ltd, New Delhi.
2. P.C. Sharma. A Text Book of Production Technology, S. Chand & Co., New Delhi.
3. D.S. Raguvanshi. A Course in Workshop Technology (Vol. I), Dhanpat Rai & Co., New Delhi.
4. S.K Hajra Choudhury and A.K. Hajra Choudhury. Elements of Workshop Technology, Vol. I. & II, Media Promoters & Publishers Pvt. Ltd., Bombay.

ME 416 (a) FINITE ELEMENT METHOD

Cr. Hrs. 3 (3 + 0)

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

Unit-I

Review of matrix algebra, theory of elasticity, stress-strain relations, strain-temperature relations, plane stress, plane strain, axisymmetric case.

Introduction to FEM with direct or stiffness formulation for bar problem. Element stiffness matrix, assembly, imposition of boundary conditions, solution of global system, stress and support reaction computation.

Computation details, storage schemes for global matrices. Solution of equations in static analysis. Gauss elimination, Cholesky's factorisation.

Unit-II

Principle of stationary (or minimum) potential energy, principle of virtual work. Rayleigh-Ritz method. Galerkin method. Variational formulation of FEM. Piecewise polynomial interpolation. Shape functions, degree of continuity. Shape functions for C0 and C1 elements. Lagrangian and Hermite interpolations. General displacement based formulation for structural problems. Consistent element nodal loads. Equilibrium and compatibility in FE model. Convergence requirements.

Finite element formulation for one dimensional bar and heat transfer problems. Linear and quadratic elements. Natural coordinates, isoparametric formulation.

Unit-III

Finite element formulation of one dimensional beam problem from minimum potential energy and Galerkin approach. Beam element. Coordinate transformations, truss and frame elements. Application to simple beam, truss and frame problems.

Unit-IV

Finite element formulation for two dimensional structural and heat transfer problems – minimum potential energy and Galerkin approaches. Natural (area) coordinates. Linear triangular element for structural (CST element) and heat transfer problems. Plane bilinear element. Isoparametric plane bilinear and triangular elements. Numerical integration, Gauss quadrature. Jacobian matrix.. Applications to simple stress analysis and heat transfer problems (restricted to CST element only).

Text Books/References

1. T. R. Chandrupatla and A. D. Belegundu. Introduction to Finite Elements in Engineering, Prentice Hall of India, New Delhi.
2. R. D. Cook, D.S. Malkus and M.E. Plesha. Concepts and Applications of Finite Element Analysis, John Wiley & Sons.
3. P. Sheshu. Text Book of Finite Element Analysis, Prentice Hall of India.
4. K.J. Bathe. Finite Element Procedure, Prentice Hall of India.

AG 411 STATISTICAL METHODS

Cr. Hrs. 3 (2 + 1)

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

Unit-I

Random variable, mathematical expectation, moment generating function, probability distribution; binomial, poisson's and normal distribution.

Unit-II

Correlation and regression analysis, rank correlation, partial correlation, multiple correlations, fitting of multiple regressions equations.

Unit-III

Test of significance, null hypothesis and alternative hypothesis, type I and II errors, level of significance, critical region, degree of freedom, Z-test and Students t-test for one sample and two sample problems, paired t-test, test of significance of simple, partial and multiple correlations, chi-square test for testing and independence of attributes, Yates's correction

Unit-IV

Analysis of variance, assumptions, general considerations in conducting experiments, uniformity trials, Fairfield Smith variance law, basic principles of experimental design, Completely Randomized Design, Randomized Block Design and Latin Square design with statistical analysis.

Text Books/References

1. S.C. Gupta. Fundamentals of Statistics by Himalaya Publishing House, New Delhi.
2. R. Rangaswami. A Text Book on Agricultural Statistics by New Age international Publishers Limited, New Delhi.
3. G.W. Snedecor and W.G. Cochran. (1968). Statistics Methods. Oxford and IBH, New Delhi.
4. Douglas C. Montgomery. Design and Analysis of Experiments. John Wiley & Sons New York.

Gen 410 ENTREPRENEURSHIP DEVELOPMENT

Cr. Hrs. 2 (0 + 2)

	L	T	P
Credit	**0**	**0**	**2**
Hours	**0**	**0**	**4**

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of horti inputs industry. Characteristics of Indian horticultural processing and export industry. Social Responsibility of Business.