

Faculty of Agricultural Engineering

B. Tech. (Agricultural Engineering)

**New Course Curriculum
to be
Implemented from 2007-08**

July 2007

**Course curriculum and Semester wise Distribution of Courses
B. Tech. (Agril. Engg.)**

Semester – I

S.N.	Course No.	Course Title	Credits
1.	BS-MATH-111	Engineering Mathematics-I	2+1=3
2.	BS-PHY-112	Engineering Physics	2+1=3
3.	BS-CT-113	Computer Programming and Data Structures	1+2=3
4.	FMP-111	Workshop Practice	0+2=2
5.	FMP-112	Engineering Drawing	0+2=2
6.	AG-111	Agronomy	1+1=2
7.	AG-112	Horticulture	1+1=2
8.	AG-113	Livestock Production & Management	1+1=2
9.	EOES-111	Engineering Chemistry	1+1=2
		Total	9+12=21
10.	PHY EDN-111	Physical Education	0+1=1(NC)
11.	LANG-111	Comprehension & Communication Skills in English	1+1=2(NC)

Semester – II

S.N.	Course No.	Course Title	Credits
1.	BS-MATH-124	Engineering Mathematics-II	2+1=3
2.	FMP-123	Workshop Technology	1+1=2
3.	APE-121	Thermodynamics	2+1=3
4.	AG-124	Soil Science	1+1=2
5.	SWCE-121	Surveying and Levelling	1+2=3
6.	FMP-124	Machine Drawing and Computer Graphics	0+2=2
7.	EOES-122	Applied Electronics and Instrumentation	2+1=3
8.	FS-121	Engineering Mechanics	2+1=3
9	BSCT-125	Database Management and Internet Applications	0+2=2
		Total	11+12=23
10.	NSS/NCC-121	National Service Scheme/ National Cadet Corps	0+1=1(NC)

Semester – III

S.N.	Course No.	Course Title	Credits
1.	FMP-235	Theory of Machines	2+1=3
2.	FMP-236	Farm Power	1+1=2
3.	BS-MATH-236	Engineering Mathematics-III	2+1=3
4.	APE-232	Engineering Properties of Biological Materials and Food Quality	1+1=2
5.	SWCE-232	Soil Mechanics	2+1=3
6.	SWCE-233	Watershed Hydrology	2+1=3
7.	IDE-231	Fluid Mechanics	2+1=3
8.	EOES-233	Electrical Circuits	2+1=3
9.	BS-STAT-237	Statistical Methods	1+1=2
		Total	15+9=24

Semester – IV

S.N.	Course No.	Course Title	Credits
1.	FMP-247	Farm Machinery and Equipment-I	1+1=2
2.	FMP-248	Tractor System and Control	1+1=2
3.	APE-243	Heat and Mass Transfer	1+1=2
4.	APE-244	Crop Process Engineering	2+1=3
5.	SWCE-244	Soil and Water Conservation Engineering	2+1=3
6.	IDE-242	Irrigation Engineering	2+1=3
7.	AG-245	Agribusiness Management and Trade	2+0=2
8.	EOES-244	Electrical Machines and Power Utilization	2+1=3
9.	FS-242	Building Materials	1+1=2
		Total	14+8=22

Semester – V

S.N.	Course No.	Course Title	Credits
1.	FMP-359	Farm Machinery and Equipment-II	1+1=2
2.	APE-355	Dairy and Food Engineering	2+1=3
3.	SWCE-355	Soil Conservation Structures Design	2+1=3
4.	IDE-353	Groundwater, Wells and Pumps	2+1=3
5.	IDE-354	Drainage Engineering	2+1=3
6.	FS-353	Strength of Material	2+1=3
7.	FS-354	Agricultural Structures & Environmental Control	2+1=3
8.	APE-356	Drying of Farm Crops	1+1=2
9.	APE-357	Storage Engineering	1+1=2
		Total	15+9=24

Semester – VI

S.N.	Course No.	Course Title	Credits
1.	AG-366	Entrepreneurship Development and Communication Skills	1+1=2
2.	APE-368	Refrigeration and Air Conditioning	1+1=2
3.	SWCE-366	Watershed Planning and Management	2+1=3
4.	IDE-365	Advanced Irrigation System Design	1+1=2
5.	IDE-366	Minor Irrigation and Command Area Development	2+1=3
6.	FMP-3610	Machine Design	2+1=3
7.	FMP-3611	Field Operation and Maintenance of Tractor and Farm Machinery	0+1=1
8.	EOES-365	Renewable Energy Sources	2+1=3
9.	FS-365	Design of Structures	2+1=3
		Total	13+9=22

Semester – VII

S.N.	Course No.	Course Title	Credits
1.	CAF (****)-47*	To be chosen from the cafeteria courses offered by each department according to the accompanied list	2+1=3
2.	CAF (****)-47*	To be chosen from the cafeteria courses offered by each department according to the accompanied list	2+1=3
3.	CAF (****)-47*	To be chosen from the cafeteria courses offered by each department according to the accompanied list	2+1=3
4.	CAF (****)-47*	To be chosen from the cafeteria courses offered by each department according to the accompanied list	2+1=3
5.	CAF (****)-47*	To be chosen from the cafeteria courses offered by each department according to the accompanied list	2+1=3
6.	GAE-473	Seminar	0+1=1
7.	GAE-474	Agricultural Engineering Project	0+6=6
		Total	10+12=22

(Note : CAF (****)-47 – Course Numbers need to be taken from the cafeteria courses of each department)

Semester – VIII

Sr. No.	Course No.	Course Title	Credits
1.	GAE-485	In Plant Training	0+25=25
		Total	0+25=25

Cafeteria Courses of Farm Machinery and Power

S.N.	Course No.	Course Title	Credits
1.	CAF-FMP-471	Tractor Design and Testing	2+1=3
2.	CAF-FMP-472	Hydraulic Drive and Control	2+1=3
3.	CAF-FMP-473	Farm Power and Machinery Management	2+1=3
4.	CAF-FMP-474	Human Engineering and Safety	2+1=3
5.	CAF-FMP-475	Production Technology of Agricultural Machinery	2+1=3
6.	CAF-FMP-476	Mechanics of Tillage and Traction	2+1=3
7.	CAF-FMP-477	CAD of Agricultural Machines	2+1=3
8.	CAF-FMP-478	Farm Machinery Design	2+1=3
		Total	16+8=24

Cafeteria Courses of Soil and Water Conservation Engineering

S.N.	Course No.	Course Title	Credits
1.	CAF-SWCE-471	Gully and Ravine Control Structures	2+1=3
2.	CAF-SWCE-472	Reservior and Farm Pond Design	2+1=3
3.	CAF-SWCE-473	Computer Application in Soil and Water Conservation Engineering	2+1=3
4.	CAF-SWCE-474	Remote Sensing and GIS Application in Natural Resources Management	2+1=3
5.	CAF-SWCE-475	System Engineering	2+1=3
6.	CAF-SWCE-476	Advance Surface Hydrology	2+1=3
		Total	12+6=18

Cafeteria Courses of Irrigation and Drainage Engineering

S.N.	Course No.	Course Title	Credits
1.	CAF-IDE-471	Micro-Irrigation System Design	2+1=3
2.	CAF-IDE-472	Environmental Engineering	2+1=3
3.	CAF-IDE-473	Remote Sensing and GIS Application	2+1=3
4.	CAF-IDE-474	Lift Irrigation System Design and Management	2+1=3
5.	CAF-IDE-475	Aqua Cultural Engineering	2+1=3
6.	CAF-IDE-476	Modeling in Water Resources	2+1=3
7.	CAF-IDE-477	Fertigation and Environmental Control for Protective Cultivation	2+1=3
8.	CAF-IDE-478	Precision Farming Techniques	2+1=3
9	CAF-IDE-479	Water Resources System Engineering	2+1=3
10	CAF-IDE-4710	Ground Water Pollution and Control	2+1=3
		Total	20+10=30

Cafeteria Courses of Agricultural Process Engineering

S.N.	Course No.	Course Title	Credits
1.	CAF-APE-471	Food Packaging Technology	2+1=3
2.	CAF-APE-472	Development of Process Products and Equipments	2+1=3
3.	CAF-APE-473	Food Processing Plant Design and Layout	2+1=3
4.	CAF-APE-474	Rice Process Engineering	2+1=3
5.	CAF-APE-475	Seed Process Engineering	2+1=3
6.	CAF-APE-476	Process Engineering of Horticultural Crop	2+1=3
7.	CAF-APE-477	Advances in Food Process Engineering	2+1=3
8	CAF-APE-478	Process Engineering of Animal Products	2+1=3
9	CAF-APE-479	Bio Process Engineering	2+1=3
10	CAF-APE-4710	Food Safety, Standards and Laws	2+1=3
11	CAF-APE-4711	Baking Technology	2+1=3
		Total	22+11=33

Cafeteria Courses of Farm Structure

S.N.	Course No.	Course Title	Credits
1.	CAF-FS-471	Estimating, Costing and Contracting	2+1=3
2.	CAF-FS-472	Green House Technology	2+1=3
3.	CAF-FS-473	Construction Technology	2+1=3
4.	CAF-FS-474	Rural Housing	2+1=3
		Total	8+4=12

Cafeteria Courses of Electrical and Other Energy Sources

S.N.	Course No.	Course Title	Credits
1.	CAF-EOES-471	Waste and By-Product Utilization	2+1=3
2.	CAF-EOES-472	Renewable Energy Technologies	2+1=3
3.	CAF-EOES-473	Control Engineering in Agriculture	2+1=3
4.	CAF-EOES-474	Utilization of Electrical Energy in Agriculture	2+1=3
5.	CAF-EOES-475	Energy Conservation and Management in Agriculture	2+1=3
6.	CAF-EOES-476	Database Management and Micro-Processor Application	2+1=3
		Total	12+6=18

DEPARTMENT WISE COURSE DISTRIBUTION

1) Basic Science and Computer Technology

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
I	BS-MATH-111	Engineering Mathematics-I	3(2+1)	II	BS-MATH-124	Engineering Mathematics-II	3(2+1)
I	BS-PHY-112	Engineering Physics	3(2+1)	II	BS-CT-125	Database Management and Internet Applications	2(0+2)
I	BS-CT-113	Computer Programming and Data Structures	3(1+2)	II	PYE-121	Physical Education (Non Credit)	-
III	BS-MATH-236	Engineering Mathematics-III	3(2+1)				
III	BS-STAT-237	Statistical Methods	2(1+1)				
		Total	14(8+6)			Total	5(2+3)
						Total	19(10+9)

2) Agricultural Science

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
I	AG-111	Agronomy	2(1+1)	II	AG-124	Soil Science	2(1+1)
I	AG-112	Horticulture	2(1+1)	IV	AG-245	Agribusiness Management and Trade	2(2+0)
I	AG-113	Animal Sciences and Dairy Science	2(1+1)	VI	AG-366	Entrepreneurship Development and Communication Skills	2(1+1)
		Total	6(3+3)			Total	6(4+2)
						Total	12(7+5)

3) General Agricultural Engineering

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
VII	GAE-473	Seminar	1(0+1)	II	GAE- 241	Hands on Training (At the end of the IV th Semester)	NC
VII	GAE-474	Agricultural Engineering Project	6(0+6)	VI	GAE- 362	Hands on Training (At the end of the VI th Semester)	NC
				VIII	GAE-485	In Plant Training	25(0+25)
		Total	7(0+7)			Total	25(0+25)
						Total	32(0+32)

4) Department of Farm Machinery and Power

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
I	FMP-111	Workshop Practice	2(0+2)	II	FMP-123	Workshop Technology	2(1+1)
I	FMP-112	Engineering Drawing	2(0+2)	II	FMP-124	Machine Drawing and Computer Graphics	2(0+2)
III	FMP-235	Theory of Machines	3(2+1)	IV	FMP-247	Farm Machinery and Equipment-I	2(1+1)
III	FMP-236	Farm Power	2(1+1)	IV	FMP-248	Tractor System and Control	2(1+1)
V	FMP-359	Farm Machinery and Equipment-II	2(1+1)	VI	FMP-3610	Machine Design	3(2+1)
				VI	FMP-3611	Field Operation and Maintenance of Tractor and Farm Machinery	1(0+1)
		Total	11(4+7)			Total	12(5+7)
						Total	23(9+14)

5) Department of Soil and Water Conservation Engineering

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
III	SWCE-232	Soil Mechanics	3(2+1)	II	SWCE-121	Surveying and Leveling	3(1+2)
III	SWCE-233	Watershed Hydrology	3(2+1)	IV	SWCE-244	Soil and Water Conservation Engineering	3(2+1)
V	SWCE-355	Soil and Water Conservation Structures	3(2+1)	VI	SWCE-366	Watershed Planning and Management	3(2+1)
		Total	9(6+3)			Total	9(5+4)
						Total	18(11+7)

6) Department of Irrigation and Drainage Engineering

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
III	IDE-231	Fluid Mechanics	3(2+1)	IV	IDE-242	Irrigation Engineering	3(2+1)
V	IDE-353	Groundwater, Wells and Pumps	3(2+1)	VI	IDE-365	Advanced Irrigation System Design	2(1+1)
V	IDE-354	Drainage Engineering	3(2+1)	VI	IDE-366	Minor Irrigation and Command Area Development	3(2+1)
		Total	9(6+3)			Total	8(5+3)
						Total	17(11+6)

7) Department of Agricultural Process Engineering

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
III	APE-232	Engineering Properties of Biological Materials and Food Quality	2(1+1)	II	APE-121	Thermodynamics	3(2+1)
V	APE-355	Dairy and Food Engineering	3(2+1)	IV	APE-243	Heat and Mass Transfer	2(1+1)
V	APE-356	Drying of Farm Crop	2(1+1)	IV	APE-244	Crop Process Engineering	3(2+1)
V	APE-357	Storage Engineering	2(1+1)	VI	APE-368	Refrigeration and Air Conditioning	2(1+1)
		Total	9(5+4)			Total	10(6+4)
						Total	19(11+8)

8) Department of Farm Structure

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
V	FS-353	Strength of Material	3(2+1)	II	FS-121	Engineering Mechanics	3(2+1)
V	FS-354	Agricultural Structures and Environmental Control	3(2+1)	IV	FS-242	Building Materials	2(1+1)
				VI	FS-365	Design of Structures	3(2+1)
		Total	6(4+2)			Total	8(5+3)
						Total	14(9+5)

9) Department of Electrical and Other Energy Sources

Odd Semester				Even Semester			
Semester	Course Number	Course Title	Credits	Semester	Course Number	Course Title	Credits
I	EOES-111	Engineering Chemistry	2(1+1)	II	EOES-122	Applied Electronics and Instrumentation	3(2+1)
III	EOES-233	Electrical Circuits	3(2+1)	IV	EOES-244	Electrical Machines and Power Utilization	3(2+1)
				VI	EOES-365	Renewable Energy Sources	3(2+1)
		Total	5(3+2)			Total	9(6+3)
						Total	14(9+5)

10) Cafeteria Courses

Odd Semester			
Semester	Course Number	Course Title	Credits
VII	CAF (****)-47*	Will be selected from the cafeteria list	15
		Total	15

Course no: BS-MATH-111

Title: Engineering Mathematics – I

Sem: I

Credit: 3 (2+1)

Differential calculus : Taylors & Maclaurins expansions, indeterminate form, curvature, asymptotes, tracing, function of two or more independent variables, partial differentiation homogeneous functions and Euler's theorem, Composite functions, total derivatives, derivative of an implicit functions, change of variable, maxima and minima, integral calculus – reduction formulae, rectification of standard curve, double and triple integrals, change of order of integration, gamma and beta functions, application of double and triple integral to find area, ordinary differential equation : exact and Bernoulli's differential equation, equation reducible to exact form by integrating factors, equation of first order and higher degree, Clairauts equations, differential equations of higher orders, method of finding complimentary function and particular integrals, method of variation of parameters, Cauchy and Legendres linear equations, simultaneous linear differential equation with constant coefficients, series solution techniques, Vector calculus: differentiation of vectors, scalar and vector point functions, vector differential operator Del, Gradient of scalar point function, Divergence and curl of a vector point function, identities involved in Del, second order differential operator lines, surface and volume integrals, stokes, divergence and Greens theorems (without proofs).

* One credit for tutorial is to be utilized for practice of solving example on the guidelines of illustrative examples, (Preferably the first and second illustrative examples on above article) given in the textbooks.

Course No: BS-PHY-112

Title: Engineering Physics

Semester: I

Credits: 3(2+1)

Theory:

Surface tension : Capillarity, surface tension by capillary rise method and Jaegers method, Viscosity : Flow of liquids. Laminar flow/streamline flow, turbulent flow, critical velocity, viscosity, coefficient of viscosity, poiseilluies equation for flow of liquid through pipes, Bernoulliies theorem, Semiconductor : Distinction between metals, insulators and semiconductor intrinsic and extrinsic semiconductor. Determination of Energy band gap in, Semiconductor. Donor & acceptor levels, LASER: Spontaneous and stimulated emission, A & B Enisteins coefficient, population inversion, He-Ne & Ruby laser, Ammonia and Ruby MASER, Hologrophy-Note, Illumination: law of illumination, luminous flux, illumination intensity, candle power, brightness, Optic Fiber: Physical structure, basic theory, mode type, input out put characteristics of optic fiber and applications, Introduction to dia, para and ferromagnetism, classification, Quantum mechanics: Wave particale duality, debrogliies concept, uncertainty principle, wave

function, time dependent and time independent Schrodinger wave equation, introduction to super – conductivity, Meissner effect, Isotope effect, Type-I and II superconductors, Josephson’ s effect DC and AC, Squids,.

Practicals :

To find the frequency of A.C. supply using an electrical vibrator, To study the induced e.m.f. as a function of velocity of the magnet, To study the variation of magnetic field with distance along the axis of a current carrying circular coil and to determine the radius of the coil, To determine the energy band gap in a semiconductor using a PN junction diode, To find the numerical aperture of optical fiber, To study the phase relationship in L.R. circuit, To study LCR circuit, To study the variations of thermo e.m.f. of a copper-constantan thermocouple with temperature, To find the wave length of light by prism, To study capillary rise method for surface tension, To study Jaeger method for surface tension, To determine viscosity by poiseuillies method, To determine viscosity by stocks method ,To determine the wavelength of laser by diffraction grating element, Divergence of laser.

Course no: BSCT-113

Title: Computer Programming and Data Structure

Sem: I

Credits: 3 (1 + 2)

Theory :-

Introduction to High Level Languages i.e. “C” language, Primary Data types, User defined data type, variable, operator, building & evaluating expression, standard library function, managing input and output, decision making, branching, looping, array, user defined function, passing the argument and returning the value, recursion, string function, structure and union, pointer, stack, push/pop operation, queue, insertion deletion operation, linked list.

Practicals:

Familiarizing with Turbo C IDE; Building an executable version of C program; Debugging a C program; Developing and executing simple programs; Creating programs using decision making statements such as if, go to & switch; Developing program using loop statements while, do & for, Using the structure control structures; Familiarizing with one and two dimensional arrays; Using string functions; Developing structures and union; Creating user defined functions; Using local, global & external variables; Using pointers; Implementing Stacks; Implementing push/pop functions; Creating queues’ Developing linked lists in C language; Insertion/Deletion in data structures.

Course no: FMP111

Title: Workshop Practice

Sem: I

Credit: 2 (0+2)

Practical: Introduction to various carpentry tools, materials, types of wood and their characteristics and Processes OR operations in wood working; Preparation of simple joints: Cross half Lap joint and T-Halving joint; Preparation of Dovetail joint, Mortise and tenon joint; Introduction to Smithy tools and operations; Jobs on Bending, shaping etc.; Jobs on Drawing, Punching, Rivetting; Introduction to tools and measuring instruments for fitting; Jobs on sawing, filing and right angle fitting of MS Flat; Practical in more complex fitting job; Operations of drilling, reaming, and threading with tap and dies; Practical test; Introduction to tools and operations in sheet metal work; Making different types of sheet metal joints using G.I. sheets.

Course no: FMP112

Title: Engineering Drawing

Sem: I

Credit: 2 (0+2)

Practical: Introduction of drawing scales; Principles of orthographic projections; Reference planes; Points and lines in space and traces of lines and planes; Auxiliary planes and true shapes of oblique plain surface; True length and inclination of lines; Projections of solids (Change of position method, alteration of ground lines); Section of solids and Interpenetration of solid-surfaces; Development of surfaces of geometrical solids; Isometric projection of geometrical solids.

Course no: AG-111

Title: Agronomy

Sem: I

Credit: 2 (1+1)

Theory:

Definition and scope of Agronomy. Classification of crops. Effect of different weather parameters on crop growth and development. Principles of tillage. Tilt and its characteristics. Tillage implements. Water requirement of crops and irrigation scheduling, crop rotation, cropping systems, mono double and multiple cropping . Relay cropping and mixed cropping. Cultivation practices of important field crops, improved varieties, seed rate, time and method of sowing, manuring, fertilization. Concept of dry farming.

Practicals:

Identifications of crops and their varieties seeds and weeds. Fertilizer application methods. Different weed control methods. Different seed bed preparation methods. Different methods of sowing and transplanting. Judging maturity time for harvesting of crop. Acquaintance with different methods of harvesting. Preparation of charts showing major agro-climatic zones and rainfall pattern Study of seed viability and germination test.

Course no: AG-112**Title: Horticulture****Sem: I****Credit: 2 (1+1)**

Theory: Scope of horticultural and vegetable crops. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties Criteria for site selection. Layout and planting methods Nursery raising, macro and micro propagation methods. Plant growing structures, pruning and training, fertilizer application, fertigation. Irrigation methods traditional and modern methods. Harvesting, harvest practices, grading and packaging. Post harvest practices. Garden tools. Management of orchard.(Construction and management of green house) Extraction and storage of vegetable seeds/Layout of lawns and kitchen gardens. Preparation of different fruits and vegetable products ,

Crops to be covered:

Fruits: Citrus, Mango, Gauva, Grapes, banana, sapota, pomegranate, ber, papaya

Vegetables: Tomato, chilli, brinjal, onion bendi, cabbage, cauliflower, cucurbit crops.

Flowers: Rose, chrysanthemum, jasmine, tuber rose, gillaridaia, merigold, gladiolus, and aster

Practicals:

Identification and descriptions of important fruit, flowers, and vegetable crops. Study of horticultural tools and implements and their uses; Containers, potting mixture, potting, depotting and repotting; Methods of pruning and training; Training of ber, grape and pomegranate; Pruning of ber, grape, phalsa, fig, apple, pear, peach; Irrigation methods in fruit crops including drip – Micro irrigation methods of establishment of orchard; Methods of Fertiliser application methods in fruit crops including fertigation technology.

Course no: AG-113

Title: Livestock Production & Management

Sem: I

Credit: 2 (1+1)

Theory:

Importance of livestock in agriculture, Basics of anatomy and physiology of Cattles, Buffalo, Sheep, Goat, poultry and their important species and breeds. General principles of breeding. care and management of livestock and poultry. Artificial insemination, semen preservation. Space and shelter layout and requirement for farm animals, poultry and fish. General principles of feeding, processing, preservation and storage of feed and fodder. Milking and clean milk production. Livestock products- handling, marketing, economics, on going efforts in the country and recent trends in livestock husbandry, poultry and fish production and processed products aspects needing engineering consideration. Draft potential of various breeds of livestock for farm operations

Practicals:

Familiarity with animal breeds. Familiarity with poultry and fish identification of body parts. Determination of body weight and age. Design and layout of animal shed, water supply and drainage. Criteria for layout of poultry pens. Study of barn, milking parlor, isolation wards, bull paddock, Heifei shed, calf pen Milking of cows and study of milking machine, Incubation, hatching and preservation of eggs , Identification of common feed stuff, Acquaintance with equipments of livestock, poultry and fish farm, Visit to feed mill, dairy and poultry farm, .Disposal of animal, poultry and fish waste and its utilization.

Title: Engineering Chemistry	Semester: I
Course No: EOES 111	Credits: 2(1+1)

Theory:

Phase rule and its application to one and two component systems. Fuels: classification, calorific value. Colloids: classification, properties. Corrosion: Definition of all type of causes corrosion, types and method of prevention. Corrosion control, Water: temporary and permanent hardness, disadvantages of hard water, scale and sludge formation in boilers, boiler corrosion. Lubricants: properties, mechanism, classification and tests. Polymers. Types of polymerization, properties, uses and methods for the determination of molecular weight of polymers.

Practicals:

Determination of temporary and permanent hardness of water by EDTA method, Estimation of chloride in water, Estimation of dissolved oxygen in water, Determination of BOD in water sample, Determination of COD in water sample; Estimation of available chlorine in bleaching powder, Determination of viscosity of oil, Estimation of alkalinity of water sample, Determination of calorific value of solid fuel, Determination of calorific value of gaseous fuel.

Syllabus for English Courses**LANG – III Comprehension and Communication Skills in English
2 (1+1) (NC) Semester – I****THEORY :**

Descriptive writing, reading comprehension-short answer questions, choice of best alternative, vocabulary exercises – word groups, word forms, synonyms and antonyms, words and phrases, derivation of adjectives from verbs, derivation of verbs from nouns, derivation of nouns from verbs comprehension tests, true or false, compound words, often confused words, homonyms and homophones, auxiliaries – modal auxiliaries.

PRACTICAL :

Applied Grammar : Articles, prepositions, verbs, tenses, voice, direct indirect speech, agreement of verb with subject, relative pronouns and relative adverbs, simple compound and complex sentences, infinitives, clauses, word order, gerunds. Use of for and since, sentence patterns.

Listening comprehension : Listening to lectures, speeches, talks.

Spoken English : Importance of stress and intonation.

Assignments on written skills, letter writing, précis writing, paragraph writing, brief essay writing.

Text : Current English for language skills by M.L. Tickoo and A.E. Subramanian, Publisher Macmillan India Limited

1. The Book of Nature : Jawaharlal Nehru
2. A Days Wait : Earnest Hemingway
3. I Was Gandh's Jailer : Partic Quinn
4. Too Dear : Leo Tolstoy
5. My Greatest Olympic Prize : Jesse Owens
- 6 & 7 Fighting the Invisible - I & II Navin Sullivan
- 8 My Struggle for an Education : Brooker T. Washington
9. Hari : Nayantara Sahgal
10. My Lost Dollar : Stephen Leacock

Course no: BSMATH-124

Title: Engineering Mathematics – II

Sem: II

Credit: 3 (2+1)

Matrices : elementary transformation, rank of matrix, reduction to normal forms, Gauss-Jordan method to find inverse of a matrix, consistency and solutions of linear equations, eigen values and eigen vectors, Cayley-Hamilton theorem, linear transformation, orthogonal transformation, diagonalization of matrixes, bilinear and quadratic forms, function of complex variable : limit, continuity and derivative of complex functions, analytic function, Cauchy – Reimann equation, conjugate functions, harmonic function. Fourier series, infinite series and its convergence, periodic functions, Eulers formulae, Dirichlet conditions, function having arbitrary period, even and odd functions, half range series, Harmonic analysis, partial differential equation: formation of partial differential equations, Lagranges linear equations, solutions of non linear partial differential equations.

* One credit for tutorial is to be utilized for practice of solving example on the guidelines of illustrative examples, (Preferably the first and second illustrative examples on above article) given in the textbooks.

Course no: FMP123

Title: Workshop Technology

Sem: II

Credit: 2 (1+1)

Theory:

Introduction to welding, types of welding, Oxyacetylene gas welding, types of flames, welding techniques and equipment. Principle of arc welding, equipment and tools. Casting processes. Classification, constructional details of center lathe, Main accessories and attachments. Main operations and tools used on center lathes. Types of shapers, Constructional details of standard shaper. Work holding devices, shaper tools and main operations. Types of drilling machines. Constructional details of pillar types and radial drilling machines. Work holding and tool holding devices. Main operations. Twist drills, drill angles and sizes. Types and classification. Constructional details and principles of operation of column and knee type universal milling machines. Plain milling cutter. Main operations on milling machine.

Practical: Introduction to welding equipment, processes tools, their use and precautions; Jobs on ARC welding – Lap joint, butt joint; T-Joint and corner joint in Arc welding; Gas welding Practice – Lab, butt and T-Joints; Introduction to metal casting equipment, tools and their use; Mould making using one-piece pattern and two pieces pattern; Demonstration of mould making using sweep pattern, and match plate patterns; Practical test; Introduction to machine shop machines and tools; Demonstration on Processes in machining and use of measuring instruments; Practical jobs on simple turning, step turning; Practical job on taper turning, drilling and threading; Operations on shaper and planer, changing a round MS rod into square section on a shaper; Demonstration of important operations on a milling machine, making a plot, gear tooth forming and indexing; Any additional job.

Thermodynamics properties. Closed and open system. 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. Kelvin Planck and Clausius statements. Entropy, physical concept of entropy, change of entropy of gases in thermodynamics processes. 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. Classification of steam boilers, Cochran, Lancashire, locomotive and Babcock-Wilcox boilers. Boiler mountings and accessories.

Practical:

Study of boilers; Study of Cochran, Lancashire, locomotive and Babcock-Wilcox boilers. Study of various mountings and accessories of boilers. Study of steam table and its application. To measure dryness fraction of steam, Determination of calorific value of food material by calorimeter (s).

Course no: AG-124**Title: Soil Science****Sem: II****Credit: 2 (1+1)****Theory:**

Definition of Soil. Rocks and minerals Soil formation, and classification. Soil survey methods. Land use capability and mapping. Major soil types of India, soil texture, classification of soil particles and their properties, bulk density, particle density and porosity, soil structure, types of soil structure and management of soil water, retention and movement, saturated and unsaturated flow, soil moisture constants. Soil temperature and soil air. Soil colloids, cation and anion exchange in soils, soil reactions and buffering capacity. Soil humus and its formation, C:N ratio. Acid, Saline and alkali soils and their reclamation. Significance of macro and micro nutrients Soil and Water testing. Important fertilizer and fertilizer recommendations.

Practicals

Study of soil profiles. Identification of different soil types. Mechanical analysis of soil. Determination of bulk density and particle density of soil. Determination of cation exchange capacity of soil. Chemical analysis of soil i.e. EC. pH. ESP. Determination of soil moisture constants. Determination of NPK in the soils Analysis of irrigation water for SAR, EC, carbonate and bicarbonate Determination of soil organic matter. Determination of liquid and plastic limits. Determination of gypsum requirement of soil., Interpretation of soil and water test data.

Course No. : SWCE – 121

Title: Surveying and Leveling

Sem : II

Credit: 3 (1+2)

Theory :

Surveying: Introduction, classification and basic principles, Linear measurements. Chain surveying. Compass survey. Errors in measurements, their elimination and correction. Plane table surveying. Levelling, Contouring, Computation of area and volume. Theodolite traversing. Introduction to setting of curves.

Practical:

Chain survey of an area and preparation of map; Compass survey of an area and plotting of compass survey; Plane table surveying; Leveling. L-section and X-sections and its plotting; Contour survey of an area and preparation of contour map; Introduction of software in drawing contour; Theodolite surveying; Ranging by theodolite, Height of object by using theodolite; Setting out curves by theodolite; Minor instruments, Use of total survey station.

Course no: FMP-124

Title: Machine Drawing and Computer

Graphics

Sem: II

Credit: 2 (0+2)

Practicals:

Methods of projection, preparation of working drawing from models and isometric views, Drawing of missing views, methods of dimensioning, concept of sectioning, revolved and oblique section. Sectional views of machine parts, Types of rivets and riveted joints, leak proof joints. Welded joints, Threads (nomenclature, single start, multi-start threads nuts, and bolts, screwed fasteners, shaft coupling and shaft bearings)

Graphic standards, primitives' graphic software, prints, lines and polygons, co-ordinate systems, geometrical modeling, wire frame modeling, surface modeling, preparation of computerized drafting by drafting software. Introduction to AutoCAD, Pro-E, workbench Ansys, 3-D software or any other available drafting software.

Course No: EOES -122	Semester: II
Title: Applied Electronics and Instrumentation	Credits : 3(2+1)

Theory:

p-n junction, V-I characteristics of p-n junction, diode as a circuit element, rectifier, clipper, clamper, voltage multiplier, capacitive filter, diode circuits for OR & AND (both positive and negative logic), Transistor as an amplifier CB, CE, CC, operating point, classification(A,B & C) of amplifier, various biasing methods (fixed, self, potential divider), h-parameter model of a transistor, CE amplifier, phase shift oscillator, ideal OP-AMP characteristics, linear and non-linear applications of OP-AMP (adder, subtractor, integrator, active rectifier, comparator, differentiator, differential, instrumentation amplifier and oscillator), zener diode voltage regulator, transistor series regulator, current limiting, OP-AMP voltage regulators, Basic theorem of Boolean algebra, Combinational logic circuits (basic gates), binary ladder D/A converter, successive approximation A/D converter, generalized instrumentation, measurement of displacement, temperature, velocity, force and pressure using potentiometer, resistance thermometer, thermocouples, bourden tube, LVDT, strain gauge and transducer.

Practical:

To study V-I characteristics of p-n junction diode; To study half wave, full wave and bridge rectifier; To study transistor characteristics in CE configurations; To study a diode as clipper and clamper; To study a OP-AMP IC 741 as inverting and noninverting amplifier; To study a OP-AMP IC 741 as differentiator amplifier; To study a zener regulator circuit; To study a OP-AMP IC 741 as a active rectifier; To study a OP-AMP IC 741 as a comparator; To familiarize with various types of transducers.

Course No. : FS-121

Title: Engineering Mechanics

Sem : II

Credit: 3 (2+1)

Theory:

Basic concepts. Force systems. Centroid. Moment of inertia. Free body diagram and equilibrium of forces. Frictional forces. Analysis of simple framed structures using methods of joints, methods of sections and graphical method. Simple stresses. Shear force and bending moment diagrams. Stresses in beams. Torsion. Analysis of plane and complex stresses.

Practicals:

Problems on; Composition and resolution of forces, moments of a force, couples, transmission of a couple, resolution of a force into a force & a couple; Problems relating to resultant of; a concurrent - coplaner force system, nonconcurrent - coplaner force system, nonconcurrent - noncoplaner force system, parallel - noncoplaner force system, system of couples in space; Problems relating to centroids of composite areas; Problems on moment of inertia, polar moment of inertia, radius of gyration, polar radius of gyration of composite areas; Equilibrium of concurrent – coplaner and nonconcurrent – coplaner force systems; Problems involving frictional forces; Analysis of simple trusses by method of joints and method of sections; Analysis of simple trusses by graphical method; Problems relating to simple stresses and strains; Problems on shear force and bending moment diagrams; Problems relating to stresses in beams; Problems on torsion of shafts; Analysis of plane and complex stresses.

Course no: BSCT-125**Title: Database Management and Internet Application****Sem: II****Credits: 2 (0 + 2)****Practicals:**

Basic database concept, DBMS Concept, introduction to RDBMS, Concept of normalization, SQL command, DML, DDL, select command, join and function, group function, set function, basic of HTML, developing the web page using meta tag, static and dynamic page, interlinking the web pages, project.

Course no: FMP-235

Title: Theory of Machines

Sem:III

Credit: 3 (2+1)

Theory:

Elements, links, pairs, kinematics chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions. Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centers. Types of gears. Law of gearing, velocity of sliding between two teeth in mesh. Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. Simple, compound, reverted, and epicyclic trains. Determining velocity ratio by tabular

method. Turning moment diagrams, co-efficient of fluctuation of speed and energy, weight of flywheel, flywheel applications. 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. Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, anti friction bearings. Types of governors. constructional details and analysis of Watt, Porter, Proell governors. Effect of friction, controlling force curves. Sensitiveness, stability, hunting, isochronism, power and effort of a governor. Static and dynamic balancing. Balancing of rotating masses in one and different planes. Partial primary balancing of reciprocating masses.

Practical: Demonstration in mechanisms study using models; Analysis of 4-bar mechanism, slider crank mechanism and their inversions; Complete velocity and acceleration analysis (Graphical or Analytical) of few practical linkage mechanisms; Study of gears and gear trains and motion analysis of some practical complex compound gear train; Motion analysis Epicyclic gear trains using tabular and formula methods; To design a compound gear train

and epicyclic gear train for a desired speed ratio; Practical test; To study the flywheel and governor action in laboratory; To graphically synthesize the cam profile for a desired standard follower motion; Study on the cam follower demonstration machine for follower displacement as a function of cam rotation angle and phenomenon of follower jump; Demonstration of static and dynamic balancing in the laboratory. Calculations on balancing a multi rotor unbalanced system by putting masses in two different planes.

Course no: FMP-236

Title: Farm Power

Sem: III

Credit: 2 (1+1)

Theory:

Sources of farm power -conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. Study of engine components their construction, operating principles and functions. Engine systems : valves & valve mechanism. Fuel & air supply, cooling, lubricating, ignition, starting and electrical systems. Study of constructional details, adjustments & operating principles of these systems. 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, study of properties of coolants, anti freeze and anti-corrosion materials, lubricant types & study of their properties. Engine governing systems.

Practical:

Introduction to different systems of an CI engine; Engine parts and functions, working principles etc; Valve system – study, construction and adjustments; Oil & Fuel - determination of physical properties; Air cleaning system; Fuel supply system of SI engine; Diesel injection system & timing; Cooling system, and fan performance, thermostat and radiator performance evaluation; Part load efficiencies & governing; Lubricating system & adjustments; Starting and electrical system; Ignition system; Tractor engine heat balance and engine performance curves; Visit to engine manufacturer/ assembler/ spare parts agency.

Course no: BSMATH-236

Title: Engineering Mathematics – III

Sem: III

Credit: 3 (2 + 1)

Numerical analysis, finite differences various difference operators and there relationship, factorial notation interpolation with equation interval, Newton's forward and backward interpolation formulae, Newton's divided difference formula, lagranges interpolation formula, numerical differentiations: differentiation based on equal interval interpolations, first and second order derivative by using Newton's forward and backward, maxima and minima of a tabulated functions, numericals integration by Trapezoidal, Simpson's, rules, difference equations: order of a difference equations, solution of linear difference equations, rules for finding complimentary functions and particular integral, numerical solution of a ordinary differential equations by Picards methods, Taylor series method, Eulers method, modified Eulers method, Laplace transforms: definition of Laplace transform, laplace transform of elementary functions, properties of laplace transforms, inverse laplace transform, transform of derivative, integrals, transform of function multiplied by t^n , transform of function divided by t. Convolution theorem application of laplace transform to solve ordinary differential equation and simultaneous differential equations, laplace transform of unit step function, unit impulse function, periodic function.

- One credit for tutorial is to be utilized for practice of solving example on the guidelines of illustrative examples, (Preferably the first and second illustrative examples on above article) given in the textbooks.

2 APE 232 **Engineering Properties of Biological Materials and Food Quality** 1+1=2

Importance of engineering properties of biological materials. Study of different physical and thermal characteristics of important biological materials like shape, size, volume, density, roundness, sphericity, surface area, specific heat, thermal conductivity, thermal diffusivity, etc. measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition. Rheological characteristics like stress, strain time effects, rheological models and their equations. Aerodynamic characteristics and frictional properties. Application of engineering properties in handling processing machines and storage structures. Concept, objectives and need of quality, quality control, methods of quality control, sampling; purpose, sampling techniques, requirements and sampling procedures for liquid, powdered and granular materials, sensory quality control, panel selection methods, interpretation of sensory results in statistical quality control, TQM and TQC, consumer preferences and acceptance.

Practical:

Determination of moisture content of grains by air oven. To find the shape and size of grains and fruits and vegetables. To determine bulk density and angle of repose of grains. To determine the particle density/true density and porosity of solid grains. To find out the co-efficient of external and internal friction of different crops. To study the separating behaviour of a grain sample in a vertical wind tunnel (Aspirator column). To find the thermal conductivity of different grains. To determine specific heat of some food grains. To determine cooking quality of rice. To determine impurities in grains. Preparation of a ready reckoner of change in unit weight of food grains as affected by change in its moisture content (w.b.) (5% - 25%). Milling quality of paddy. Determination of hardness of food material.

Course No. : SWCE – 232

Title: Soil Mechanics

Sem : III

Credit: 3 (2+1)

Theory :

Introduction of soil mechanics, field of soil mechanics, phase diagram physical and index properties of soil classification of soils, general classification based on particles size, textural classification and I.S. soil classification system stress condition in soils, effective and neutral stress, Permeability and seepage, Shear strength mohr stress circle, theoretical relationship between principle stress circle, theoretical relationship between principal stress mohr-coulomb failure theory, effective stress principle. Determination of shear parameters by direct shear to be circle, theoretical test. Numerical exercise based on various types of tests. Compaction composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction text field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi' s theory Laboratory consolidation text, calculation of void ratio and coefficient of volume change, Taylor' s and Casagrand' s method, determination of coefficient of consolidation. Earth pressure: Plastic equilibrium in soils Active and passive states, Rankine' s theory of earth pressure active and passive earth pressure for cohesive soils, simple numerical exercise. Stability of slopes: Introduction to stability Analysis of infinite and finite slopes friction circles method Taylor' s stability number.

Practical:

Determination of water content of soil; Determination of specific gravity of soil; Determination of field density of soil by core cutter method; Determination of field density by sand replacement method; Grain size analysis by sieving (Dry sieve analysis); Grain size analysis by hydrometer method; Determination of liquid limit by Casagrande' s method; Determination of plastic limit; Determination of shrinkage limit; Determination of permeability by constant head method; Determination of permeability by variable head method; Determination of compaction properties by standard proctor test; Determination of shear parameters by Direct shear test; Determination of unconfined compressive strength of soil.

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Course No. : SWCE – 233

Title: Watershed Hydrology

Sem : III

Credit: 3 (2+1)

Theory:

Introduction; hydrologic cycle; precipitation - forms, rainfall measurement, mass curve, hyetograph, mean rainfall depth, frequency analysis of point rainfall, plotting position, estimation of missing data, test for consistency of rainfall records; 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; rational method, Cook's method, SCS method and volume by Curve number method; 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; head water flood control methods, flood routing – graphical methods of reservoir flood routing; hydrology of dry land areas - drought and its classification; introduction to watershed management and planning.

Practical:

Visit to meteorological observatory; Study of different types of rain gauges; Exercise on analysis of rainfall data; Determination of average depth of rainfall and frequency analysis; Study of stage recorders and current meters; Exercise on estimation of peak runoff rate and runoff volume; Exercises on hydrograph and unit hydrograph; Exercises on flood routing problems.

IDE-231

FLUID MECHANICS

3 (2+1)

Theory

Properties of fluids: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, metacentre and metacentric height, condition of floatation and stability of submerged and floating bodies; Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice-meter and nozzle, siphon; Flow through notches, weirs and open channel; Laminar flow: Stress-strain relationships, flow between infinite parallel plates - both plates fixed, one plate moving, discharge, average velocity, shear stress and pressure gradient; Laminar and turbulent flow in pipes, general equation for head loss - Darcy, Equation, Moody's diagram, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient, power transmission through pipe; Dimensional analysis and similitude: Rayleigh's method and Buckingham's 'Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid machinery.

Practicals-

Study of manometers and pressure gauges; Verification of Bernoulli's theorem; Determination of coefficient of discharge of venturimeter and orifice meter; Determination of coefficient of friction in pipeline; Determination of coefficient of discharge for rectangular and triangular notch; Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice; Determination of coefficient of discharge for mouth piece; Measurement of force exerted by water-jets on flat and hemispherical vanes ; Determination of metacentric height; Determination of efficiency of hydraulic ram; Performance evaluation of Pelton and Francis turbine; Study of current meter; Velocity distribution in open channels and determination of Manning's coefficient of rugosity

Title: Electrical Circuit	Semester: III
Course No: EOES-233	Credits: 3 (2+1)

Theory:

Average and effective value of sinusoidal and linear periodic waveforms. Independent and dependent sources, loop current and loop equations (Mesh current method), node voltage and node equations (Nodal voltage method), Network theorems: Thevenin' s, Norton' s, Superposition, Reciprocity and Maximum power transfer, Star- Delta conversion solution of DC circuit by Network theorems, Sinusoidal steady state response of circuits, Instantaneous and average power, power factor, reactive and apparent power, Concept and analysis of balanced polyphase circuits, Disadvantages of low power factor and power factor improvement, various methods of single and three phase power measurement, staircase and go down wiring.

Practical:

To familiarize with the components and equipments used in Laboratory.,To verify Kirchhoff' s current laws,To verify Kirchhoff' s voltage laws,To verify Thevenin theorems,To verify Norton' s theorems,To verify Superposition theorem, To verify reciprocity theorem,To study the sinusoidal response of RL series circuit,To study the sinusoidal response of RC series circuit,To study the step response of RC series circuit,To study power consumed in a three-phase circuit,To study the staircase and go down wiring,To study the power factor improvement.

Course no: BS STAT - 237

Title: Statistical Methods

Sem: III

Credits: 2 (1+1)

Theory :

Statistics, Scope, population parameter and Estimates. Measures of Central Tendency : Arithmetic, Weighted, Geometric and Harmonic means, median and Mode for grouped and ungrouped data. Measures of Dispersion : Mean Deviation Variance, Standard Deviation and Coefficient of Variation. Concepts of probability, compound events, Additive, multiplicative, Theorems, independent Events, Discrete and continuous Theoretical Probability Distributions, Density functions, Binomial, Poisson, Normal, Chi-square, t,F distributions. Simple, partial, multiple correlations Theory of regression, Multiple Regression models and orthogonal polynomials. Tests of significance Null and Alternative hypotheses critical Region, Level of significance, Degrees of freedom, Types of Errors , Confidence intervals.

Practicals:

Measures of central Tendency in Ungrouped and grouped data, Measures of Dispersion in ungrouped and grouped data, Skewness and Kurtosis, correlation and Regression, Fitting of the Binomial, Poisson and Normal distributions, Applications of t, F and Chi-square tests Large sample tests.

Course no: FMP 247

Title: Farm Machinery & Equipment-I

Sem: IV

Credit: 2 (1+1)

Theory: Objectives of farm mechanization. Classification of farm machines. Materials of construction & heat treatment. Principles of operation and selection of machines used for production of crops. Field capacities & economics. Tillage; primary and secondary tillage equipment. Forces acting on tillage tools. Hitching systems and controls. Draft measurement of tillage equipment : Earth moving equipment - their construction & working principles viz Bulldozer, Trencher, Elevators etc.; sowing, planting & transplanting equipment - their calibration and adjustments. Fertilizer application equipment. Weed control and Plant protection equipment - sprayers and dusters, their calibration, selection, constructional features of different components and adjustments.

Practical: Introduction to various farm machines, visit to implements shed and research hall; Field capacity and field efficiency measurement for at least two machines/implements; Draft & fuel consumption measurement for different implements under different soil conditions; Construction details, adjustments and working of M.B. plow, disc plow and disc harrow and secondary tillage tools; Introduction, construction and working of earth moving equipment; Construction and working of rotavators and other rotary tillers, measurement of speed & working width; Working of seed-cum-fertilizer drills, planters and their calibration in field; Working of transplanters and operation; Weeding equipments and their use; Study of sprayers, dusters, measurement of nozzle discharge, field capacity etc.

Course no: FMP 248

Title: Tractor Systems and Controls

Sem: IV

Credit: 2 (1+1)

Theory: Study of transmission systems, clutch, gear box, differential and final drive mechanism Familiarization of brake mechanism. Ackerman and hydraulic steering and hydraulic systems. Tractor power outlets: P.T.O., belt pulley, drawbar, etc. Tractor chassis mechanics and design for tractor stability. Ergonomic considerations and operational safety.

Practical: Introduction to transmission systems and components; Study of clutch functioning, parts and design problem on clutch system; Study of different types of gear box, calculation of speed ratios, design problems on gear box; Study on differential and final drive and planetary gears; Study of brake systems and some design problems; Steering geometry and adjustments; Study of hydraulic systems in a tractor, hydraulic trailer and some design problems; Traction performance of a tractor wheel; Finding C.G. of a tractor by weighing technique; Finding CG of a tractor using suspension/balancing techniques; Finding moment of Inertia of a tractor; Appraisal of various controls in different makes tractors in relation to anthropometric measurements.

Theory- Introductory concepts. Modes of heat transfer. Thermal conductivity of materials, measurement. General differential equation of conduction. One dimensional steady state conduction through plane and composite walls, tubes and spheres. Electrical analogy. Insulation materials, critical thickness of insulation. Free and forced convection. Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free convection. Laminar forced convection on a flat plate and in a tube. Combined free and forced convection. Introduction. Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, gray bodies and emissive power, solid angle, intensity of radiation. Types of heat exchangers, fouling factor, log mean temperature difference.

Heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow, Fick's law, mass transfer coefficients. Types of mass transfer.

Practical-

Determination Thermal conductivity of solid Composite wall, Determination of thermal conductivity of a food material. Determination of overall heat transfer coefficient, Determination of heat transfer coefficient of a boiling liquid, Determination of thermal conductivity through plat composite wall, in packed beds, Determination of overall heat transfer coefficient in parallel flow and counter flow heat exchangers. Measurement of emissivity of a surface. Study of heat exchanger (plate type, tubular,) To verify Stefan-Boltzman relationship; To determine the emissivity of a given material.

Scope and importance of food processing, principles and methods of food processing. Processing of farm crops: cereals, pulses, oil seeds, fiber crops, fruits and vegetables and their products for food and feed. Principal of size reduction, grain shape, size reduction machines; crushers, grinders, cutting machines etc. - operation, efficiency and power requirement – Rittinger's, Kick's and Bond's equation, fineness modulus. pressure drop during filtration. Theory of mixing, types of mixtures for dry and paste. materials, rate of mixing and power requirement, mixing index. Theory of separation, size and un-sized separation, types of separators, size of screens, sieve analysis, capacity and effectiveness of screens, pneumatic separation. Theory of filtration, study of different types of filters, rate of filtration, Scope & importance of material handling devices. Study of different types of material handling systems; belt, chain and screw conveyor, bucket elevator, pneumatic conveying, Design consideration, capacity and power requirement.

Practical-

Preparation of flow and layout charts of a food processing plant; Determination of fineness modulus and uniformity index; Performance evaluation of hammer mill; Performance evaluation of attrition mill; Study of cleaning equipment; Study of fruit washers. Study of grading and sorting equipment; Evaluation of performance of indented cylinder and screen pre-cleaner; Study of mixers; Study of conveying equipments; Performance evaluation of bucket elevator. Visit to crop processing plant.

Course No. : SWCE – 244

Title: Soil and Water Conservation Engineering

Sem : IV

Credit: 3 (2+1)

Theory:

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; 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; gully and ravine reclamation - principles of gully control - vegetative and temporary structures; wind erosion - factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, wind erosion control measures - vegetative, mechanical measures, wind breaks & shelter belts,

sedimentation - sedimentation in reservoirs and streams, estimation and measurement, sediment delivery ratio, trap efficiency; characteristics of contours and preparation of contour maps; land use capability classification; grassed water ways and their design; introduction to water harvesting techniques; introduction to stream water quality and pollution.

Practical:

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

Theory

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; 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; land grading, different design methods and estimation of earth work and cost; soil water plant relationship, soil water movement, infiltration and its equations, evapotranspiration, soil moisture constants, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface irrigation methods of water application, border, check basin, furrow and contour irrigation.

Practical

Measurement of soil moisture by different soil moisture measuring instruments; Measurement of irrigation water; Measurement of infiltration characteristics; Determination of bulk density, field capacity and wilting point; Estimation of evapotranspiration; Land grading exercises; Design of under ground pipeline system; Estimation of irrigation efficiency; Study of advance, recession and computation of opportunity time; Infiltration by in flow outflow method; Evaluation of border Irrigation method; Evaluation of furrow irrigation method; Evaluation of check basin irrigation method

Course No: AG-245**Title: AgriBusiness Management and Trade****Sem: IV****Credit: 2 (2+0)****Theory:**

Basics of agri-business management : Planning; organizing, controlling; Leading; Forecasting for Agril. Business; Location and layout of Facilities : Work force management; Quality management, Maintenance; Financial Analysis of Agribusiness process Strategy; Inventory management.

Title: Electrical Machines and Power Utilization	Semester: IV
Course No: EOES-244	Credits : 3 (2+1)

Theory:

Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses, Transformer: principle of working, construction of single phase transformer, EMF equation, transformer on load, voltage regulation, power and energy efficiency, open circuit and short circuit tests, principles, operation and performance of DC machine (generator and motor), EMF and torque equations, armature reaction, commutation, excitation of DC generator and their characteristics, DC motor characteristics, starting of shunt and series motor, starters, speed control methods-field and armature control, polyphase induction motor: construction, operation, effect of rotor resistance, torque equation, starting and speed control methods, single phase induction motor: double field revolving theory, characteristics, phase split, shaded pole motors

Practical:

To get familiar with AC, DC machines and measuring instruments; To perform open circuit and short circuit tests on a single phase transformer and hence find voltage regulation and efficiency; To study the constructional details of D.C. machine and to draw sketches of different components; To obtain load characteristics of d.c. shunt/series /compound generator; To study characteristics of DC shunt/ series motors; To study d.c. motor starters; To Perform load-test on 3 ph. induction motor & to plot torque V/S speed characteristics; To perform no-load & blocked rotor tests on 3 ph. Induction motor to obtain ckt. parameters & to draw circle diagram; To study the speed control of 3 ph. induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor; To study star delta starters physically and (a) to draw electrical connection diagram (b) to start the 3 ph. induction motor using it. (c) to reverse the direction of 3 ph. I.M.; To start a 3-phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. and to plot torque –speed characteristics; To perform no load & blocked –rotor test on 1 ph. induction motor & to determine the parameters of equivalent ckt. drawn on the basis of double revolving field theory; To perform load test on 1 ph. induction motor & plot torque –speed characteristics.

Course No: FMP 359**Title: Farm Machinery & Equipment-II****Sem: V****Credit: 2 (1+1)****Theory:**

Principles & types of cutting mechanisms. Construction & adjustments of shear & impact-type cutting mechanisms. Crop harvesting machinery : mowers, windrowers, reapers, reaper binders and forage harvesters. Forage chopping & handling equipment. Threshing mechanics & various types of threshers. Threshers, straw combines & grain combines, maize harvesting & shelling equipment, Root crop harvesting equipment - potato, groundnut etc., Cotton picking & Sugarcane harvesting equipment. Principles of fruit harvesting tools and machines. Horticultural tools and gadgets. Testing of farm machine. Test codes & procedure. Interpretation of test results. Selection and management of farm machines for optimum performance.

Practical: Familiarization with various Farm machines related to harvesting, threshing, root. harvesting, combine etc; Study of various types of mowers, constructional details, materials and working; Study of various types of reaper, constructional details, materials and working & performance; Study of various types of reaper binder, constructional details, materials and working; Study of various types of potato harvesters, constructional details, materials and working; Study of various types of groundnut harvesters, constructional details, materials and working & performance; Study of various types of forage harvester, constructional details, materials and working; Study of various types of sugarcane harvester, constructional details, materials and working; Study of various types of maize sheller, constructional details, materials and working & performance; Study of various types of threshers, constructional details, materials and working & performance; Study of various types of cotton pickers and strippers, constructional details, materials and working; Study of various types of harvester tools, constructional details, materials and working; Study of various types of combine harvester, constructional details, materials and working; Study of various types of straw combines, constructional details, materials and working; Study of various types of fruit harvester equipment, constructional details, materials and working.

APE 355 **Dairy and Food Engineering** 2 + 1 = 3

Unit operation of various dairy and food processing systems. Engineering, thermal and chemical properties of milk and milk products. Process flow charts for product manufacture. Material and energy balances. Working principles of equipments for receiving, pasteurization, sterilization, homogenisation, filling & packaging. Dairy plant design and layout. Composition and proximate analysis of food products. Deterioration in products and their controls. Physical, chemical and biological methods of food preservation, changes undergone by the food components during processing, evaporation, drying, freezing juice extraction, filtration, membrane separation, thermal processing. Food packaging. Plant utilities requirement.

Practical

Study of a composite pilot milk processing plant & equipments; Study of pasteurisers; Study of sterilizers; Study of homogenisers; Study of separators; Study of butter churners; Study of evaporators; Study of milk dryers; Study of freezers; Design of food processing plants & preparation of layout; Visit to multi-product dairy plant; Determination of physical properties of food products; Estimation of steam requirements; Visit to Food industry.

Theory:

Introduction; classification of structures, functional requirements of soil erosion control structures; flow in open channels-types of flow, state of flow, regimes of flow, energy and momentum principles, specific energy and specific force; hydraulic jump and its application, type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy; runoff measuring structures-parshall flume, H - flume and weirs; straight drop spillway - general description, functional use, advantages and disadvantages, structural parts and functions; components of spillway, hydrologic and hydraulic design, free board and wave free board, structural design of a drop spillway- forces on retaining wall, determination of saturation line, seepage under the structure, uplift pressure estimation, safety against sliding, overturning, crushing and tension; chute spillway general description and its components, hydraulic design, energy dissipaters, design criteria of a SAF stilling basin and its limitations, drop inlet spillway- general description, functional use, design criteria; design of diversions; small earth embankments-their types and design principles, farm ponds and reservoirs, cost estimation of structures.

Practical:

Study of H-flume; Study of Parshall flume; Construction of specific energy and specific force diagram; Measurement of hydraulic jump parameters and amount of energy dissipation; Hydraulic design of a straight drop spillway; Determination of uplift force and construction of uplift pressure diagram; Determination of loads on headwall and construction of triangular load diagram; Stability analysis of a straight drop spillway; Hydraulic design of a chute spillway; Design of a SAF energy dissipater; Design of small earth embankments and water harvesting structures; Cost estimation of structures.

Theory

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, 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, 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; 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

Verification of Darcy's Law; Study of different drilling equipments; Sieve analysis for gravel and well screens design; Estimation of specific yield and specific retention; Testing of well screen; Estimation of aquifer parameters by Theis method, Coopers-Jacob method, Chow method; Theis Recovery method; Well design under confined and unconfined conditions; Well losses and well efficiency; Estimating ground water balance; Study of artificial ground water recharge structures; Study of radial flow and mixed flow centrifugal pumps, multistage centrifugal pumps, turbine, propeller and other pumps; Installation of centrifugal pump; Testing of centrifugal pump and study of cavitations; Study of hydraulic ram; Study and testing of submersible pump

Theory

Drainage, objectives of drainage, familiarization with the drainage problems of the state, Surface drainage, drainage coefficient, types of surface drainage, design of open channel, sub-surface drainage purpose and benefits, investigations of design parameters, hydraulic conductivity, drainable porosity, water table etc., drainage criteria, types and use of subsurface drainage system, Design of surface drains, interceptor and relief drains. Derivation of ellipse (Hooghoudt's) and Ernst's drain spacing equations. Steady and unsteady state groundwater condition, dynamic equilibrium concept, Design of subsurface drainage system. 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

In-situ measurement of hydraulic conductivity by single auger hole method; *In-situ* measurement of hydraulic conductivity by inverse auger hole method; Determination of drainage coefficients; Installation of piezometer and observation well; Preparation of iso-bath and isobar maps; Determination of drainable porosity by sand tank model; Determination of drainable porosity by using field method; Design of surface drainage systems; Design of gravel envelop; Design of subsurface drainage systems; Determination of chemical properties of soil and water; Study of drainage tiles; Determination of gypsum requirement for land reclamation; Installation of sub-surface drainage system; Cost analysis of surface and sub-surface drainage system.

Course No. : FS-353

Title: Strength of Materials

Sem : V

Credit: 3 (2+1)

Theory :

Slope and deflection of beams using integration techniques, moment area theorems and conjugate beam method. Columns and Struts. Riveted and welded connections. Stability of masonry dams. Analysis of statically intermediate beams. Propped beams. Fixed and continuous beam analysis using superposition, three moment equation and moment distribution methods.

Practicals:

To perform the tension test on metal specimen (M.S., C.I.), to observe the behaviour of materials under load, to calculate the value of E, ultimate stress, permissible stress, percentage elongation etc. and to study its fracture; To perform the compression test on; Concrete cylinders & cubes, C.I., M.S. & Wood specimens and to determine various physical and mechanical properties; To perform the bending test on the specimens; M.S. Girder, Wooden beam, Plain concrete beams & R.C.C. beam, and to determine the various physical and mechanical properties; To determine Young's modulus of elasticity of beam with the help of deflection produced at centre due to loads placed at centre & quarter points; To study the behaviour of materials (G.I. pipes, M.S., C.I.) under torsion and to evaluate various elastic constants; To study load deflection and other physical properties of closely coiled helical spring in tension and compression; To perform the Rockwell, Vicker's and Brinell's Hardness tests on the given specimens; To perform the Drop Hammer Test, Izod Test and Charpay's impact tests on the given specimens.

Course No. : FS-354

Title: Agricultural Structures & Environmental Control

Sem : V

Credit: 3(2+1)

Theory:

Planning and layout of farmstead. Physiological reactions of livestock to solar radiation and other environmental factors, livestock production facilities, BIS Standards for dairy, piggery, poultry and other farm structures. Design, construction and cost estimation of farm structures; animal shelters, compost pit, silo, fencing and implement sheds. Design and construction of rural grain storage system and development of rural roads, their construction cost and repair and maintenance. Sources of water supply, norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community. Sewage system- its design, design of septic tank for small family. Scope, importance and need for environmental control for protected agriculture/ precision farming.

Practicals :

Instruments for measurements of environmental parameters. Cooling load of a farm building e.g.poultry house. Moisture condensation in agricultural buildings. Design and layout of a dairy farm. Design and layout of a poultry house. Design and layout of a sheep/goat house. Design of a biogas plant. Design of a farm fencing system. Design of ventilation system for dairy and poultry house. Design of a feed/fodder storage structures. Familiarization with local grain storage structures. Design of grain storage structures. Cost estimation of a farm buildings.

Theory-

Moisture content and methods for determination. Importance of EMC and methods of its determination, EMC curve and EMC model. Principle of drying. Theory of diffusion, Mechanism of drying - falling rate, constant rate, thin layer, deep bed and their analysis, Critical moisture content. Drying models, calculation of drying air temperature and air flow rate. Air pressure within the grain bed, Shedd's and Hukill's equation. Different methods of drying including puff drying, foam mat drying, freeze drying, etc. Study of different types of dryers- performance, energy utilization pattern and efficiency. Study of drying and dehydration of agricultural products.

Practical

Measurement of moisture content during drying and aeration; Measurement of relative humidity during drying and aeration using different techniques; Measurement of air velocity during drying and aeration; Drying characteristic and determination of drying constant; Determination of EMC and ERH; Study of various types of dryers. Visit to food drying industries.

Theory-

Types and causes of spoilage in storage. Conditions for storage of perishable products, Functional requirements of storage. Air movement inside the storage, Storage of grains. Destructive agents, Respiration of grains, Moisture and temperature changes in stored grains. Conditioning of environment inside storage through natural ventilation, mechanical ventilation. Artificial drying, Grain storage structures including Silo, CAP, Warehouse. Storage of grains and their products, Storage of seeds, hermetically sealed and air-cooled storages-refrigerated. Control of temperature and relative humidities inside storage. Modified atmospheric storage and Control of its environment, Controlled atmosphere. modified atmospheric and frozen storages. Storage condition for various fruits and vegetables under cold and CA storage system. Economic aspects of storage.

Practical

To study the effect of relative humidity and temperature on grains stored in gunny bags and bins; Design and layout of commercial bag storage facilities; Design and layout of commercial bulk storage facilities; Study of different domestic storage structures; Visits to commercial handling and storage facilities for grains.

Title: Entrepreneurship Development and Communication Skills**Theory:**

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 agriculture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of agri inputs industry. Characteristics of Indian agricultural processing and export industry. Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practicals:

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations.

Theory- Principles of refrigeration. Second law of thermodynamics applied to refrigeration. Carnot cycle. Reversed Carnot cycle. Coefficient of performance, Unit of refrigeration. Refrigeration in food industry, Types of refrigeration systems, Mechanical vapour compression, Vapour absorption system. Components of mechanical refrigeration system, refrigerant, Desirable properties of ideal refrigerant. Cold storages. Insulation material, design of cold storages, defrosting. Thermodynamic properties of moist air. adiabatic saturation process, wet bulb temperature and its measurement, psychometric chart and its use, elementary psychometric processes. Air conditioning, principles, type and functions of air conditioning, physiological principles in air conditioning. Humidifiers and dehumidifiers, cooling load and calculations, types of air conditioners, applications.

Practical

Study of vapour compression and vapour absorption systems; Solving problems of refrigeration on vapour compression and absorption system; Experiment on the coefficient of performance of a domestic refrigerator; Experiments with the refrigeration tutor to study various components of refrigeration; Determination of the coefficient of performance of the refrigeration tutor; Visit to a cold storage plant and air conditioning unit; Experiments with air conditioning tutor to study various components; Determination of the coefficient of performance of air conditioning tutor; Experiment on humidifier for the determination of humidifying efficiency; Estimation of refrigeration load; Estimation of cooling load, Estimation of humidification and dehumidification load; Design of complete cold storage system. Estimation of refrigeration requirements in dairy & food plant. Visit to Cold storages and large A.C. Units.

Course No. : SWCE – 366

Title: Watershed Planning and Management

Sem : VI

Credit: 3 (2+1)

Theory :

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, 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; 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; 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; land use models; case studies.

Practicals-

Preparation of command area development layout plan; Irrigation water requirement of crops; Preparation of irrigation schedules; Design of lined irrigation canal; Planning and layout of water conveyance system; Hydraulic design of canal outlets; Hydraulics design of straight Glacis fall; Hydraulic design of aqueduct; Hydraulic design of siphon; Design of irrigation systems; Conjunctive water use planning; Determination of operation schedule for canal outlets based on rotational water supply; Technical feasibility and economic viability of a command area project; Study tour to minor irrigation and command area development projects

Course No: FMP 3610**Title: Machine Design****Sem: VI****Credit: 3 (2+1)****Theory:**

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. Elementary fatigue and creep aspects. Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of welded subjected to static loads. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear and bolted joints subjected to eccentric loading. Design of shafts under

torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings. Design of helical and leaf springs. Design of flat belt and V-belt drives and pulleys. Design of gears. Design of brackets, levers, columns, thin cylindrical and spherical shells. Design of screw motion mechanisms like screw jack, lead screw, etc. Selection of anifriction bearings. Design of curved beams; Crane hooks, circular rings, etc.

Practical: Problems based on load and stress analysis of machine components; Problems based on practical application of theories of failure and fatigue and determination of factor of safety; Design and drawing of pin connections, Knuckle joint; Design of bolted joints cases of electric loading; Exercises on design of levers rockers arm for diesel engines; Assignment test; Problems on design of shafts, keys and coupling; Problems in selection/ design of belts; Selection of roller bearings use of catalogue; Problems on design of helical and leaf spring;

Problems on gear design of spur gears.

Course No: FMP 3611

Sem: VI

Credit: 1(0+1)

Title: Field Operation & Maintenance of Tractor & Farm Machinery

Practical: Familiarization with tractor and power tiller, learning procedure of tractor starting and stopping. Driving in forward and reverse gears. Driving safety rules. Hitching, adjustments, settings and field operation of farm machineries. Road signs, traffic rules, road safety, driving & parking of tractor; Tractor driving practice with tractor trailer in forward & reverse; Introduction to tractor maintenance procedure and schedule. Trouble shooting of tractor. Care and maintenance of agril. Machineries in operation and off season storage.

Title: Renewable Energy Sources	Semester: VI
Course No: EOES 365	Credits : 3 (2+1)

Theory:

Classification of energy sources; Introduction to renewable energy sources; characterization of biomass; types, construction, working principle, uses and safety/environmental aspects of different renewable energy devices like gasifiers, biogas plants, solar passive heating devices, photovoltaic cells and arrays; Brief introduction to wind energy, hydroelectric energy, ocean energy, briquetting and baling of biomass, biomass combustion, biodiesel preparation and energy conservation in agriculture.

Practicals:

Preparation of biomass sample ,Determination of calorific value;Determination of proximate analysis,Demonstration of down draft throatless rice husk gasifier; Demonstration of down draft gasifier with throat;Demonstration of rice husk gasifier for thermal use; Demonstration of working of a fixed dome type biogas plants; Demonstrations of working of a floating drum type biogas plants; Demonstration of biodiesel preparation; Measurement of basic solar parameters; Demonstration of solar water heater; Demonstration of PVC; Demonstration of solar cooker; Determination of fuel properties.

Course No. : FS-365

Title: Design of Structures

Sem : VI

Credit: 3 (2+1)

Theory: Loads and use of BIS Codes. Design of connections. Design of structural steel members in tension, compression and bending. Design of steel roof truss. Analysis and design of singly and doubly reinforced sections, Shear, Bond and Torsion. Design of Flanged Beams, Slabs, Columns, Foundations, Retaining walls and Silos.

Practicals:

Design and drawing of steel roof truss; Design and drawing of RCC building; Design and drawing of Retaining wall.

CAFETERIA COURSES

CAF-IDE-471 MICRO IRRIGATION SYSTEMS DESIGN

3 (2+1)

Theory

Scope of Micro-irrigation system, types; water requirement of crops – plantation and row crops; Drip irrigation: Emitters – types, hydraulic characteristics, selection; Lateral and manifold – layout, hydraulics and design; Main and sub-main – layout, hydraulics and design; Micro-sprinklers: accessories, types, hydraulic characteristics, selection; Control head – valves, gauges, watermeter, fittings and accessories; Filtration unit – types and adaptability, design and layout; Fertigation – types of fertigation equipment, fertilizer application criteria, suitability of fertilizer compounds, fertilizer mixing, injection duration, rate and frequency, capacity of fertilizer tank; Design, design synthesis of micro-irrigation system; Quality control and standards in micro-irrigation components; Maintenance – irrigation water quality, types of clogging, remedies, schedule; Installation of Micro-irrigation system; Automation of Micro-irrigation system; Micro-irrigation in controlled environment; Landscape irrigation; Benefit and Cost analysis of Micro-irrigation system.

Practicals

Estimation of water requirement of different crops under micro-irrigation system; Hydraulic design of lateral; Hydraulic design of main and sub-main; Determination of fertilizer injection rate; Determination of capacity of fertilizer tank; Design of water filtration unit; Design and layout of drip irrigation system for an orchard; Design and layout of drip irrigation system for row crops; Design and layout of micro-sprinkler irrigation system for plantation crops; Design and layout of micro-sprinkler irrigation system for close growing crops; Estimations for acid treatment and chlorination; Installation of drip irrigation system; Installation of micro-sprinkler irrigation system; Study of components of automation in micro-irrigation system; Design of landscape irrigation system; Field visit of micro-irrigation system

CAF-IDE-472

ENVIRONMENTAL ENGINEERING

3 (2+1)

Theory

Importance of safe water supply system. Domestic water requirements for urban and rural areas. Sources of Water supply. Intakes and transportation of water. Drinking water quality. Indian Standards of drinking water. Introduction to water treatment. Importance of sanitation. Domestic waste water: quantity, characteristics, disposal in urban and rural areas. Sewer: types, design discharge and hydraulic design. Introduction to domestic wastewater treatment. Design of septic tank. 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. ISI standards for pollutants in air and their abetments.

Practicals

Determination of turbidity; pH of solution; Suspended solids; Dissolved solids; Total solids; Determination of Temporary hardness; Determination of Permanent hardness; Fluorides; Chlorides, dissolved oxygen; Determination of BOD and COD; Collection of air samples and their analysis; Estimation of water demand; Design of water distribution system; Design of sewer system; Visit to treatment plant

CAF-IDE-473 REMOTE SENSING AND GIS APPLICATION

3 (2+1)

Theory

Remote Sensing: Definition, stages in remote sensing, modern remote sensing technology versus conventional aerial photography; remote sensing satellite, types of images, basic principle of image interpretation, types of image interpretation, factors governing the quality of an image; factors governing interpretability, visibility of objects, elements of image interpretation, techniques of image interpretation, digital image processing, digital image; digital image processing software, remote sensing for agriculture, water resource management, microwave radiometry for monitoring of agriculture crops and hydrologic forecasting; aerial photo interpretation for water resources development and land use survey.

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, data format- point, line, vector-raster - polygon-object structural model, files, files organization-data base management systems, entering data in computer-digitizer-scanner-data compression, global positioning system.

Application of remote sensing and GIS for the management of land and water resources; river basin management and command area management, using GIS for decision making process

Practicals-

Familiarization with remote sensing and GIS hardware and software; Use of instruments for aerial photo interpretation; Interpretation of aerial photographs; Study of various features of RS software; Interpretation of satellite imagery with RS software; Study the various features of GIS software package; Basic GIS operations such as image display; Scanning and digitization of maps; Data base query and map algebra; Study of global positioning system; RS and GIS supported case studies in water resources management; Study of spatial decision support system

CAF-IDE-474

LIFT IRRIGATION SYSTEM DESIGN AND MANAGEMENT

3 (2+1)

Theory

Site selection for lift irrigation and reconnaissance survey, survey and mapping of field, cropping pattern and computing water requirement selection of site for intake and jackwell, computing total head and power requirement, Design of intake chambers, inlet pipe and pump house, selection of pump, pump layout and connection. Design and layout of rising main, distribution system and delivery chamber, working out water rates.

Practicals

Selection of site for lift irrigation scheme and reconnaissance survey; Surveying and mapping of the field; Cropping pattern and computing water requirements; Selection of site for intake and Jack well; Computing total head and power requirement; Design of intake chamber, inlet pipe and pump house; Selection of pump; Study of piping joints like R.C.C., cast iron, HDPE; Study of air valves like air vent, Sluice valve, non return, pressure relief valves; Study of pressure gauge; Pump layout and connection; Designing and layout of rising main; Designing and layout of distribution system and delivery chamber; Working out water rates; Preparing plans and estimates; Feasibility of scheme, working out cost benefit ratio; Preparation of lift irrigation scheme; Field visits to lift irrigation projects

CAF-IDE- 475 AQUA CULTURAL ENGINEERING**3(2+1)****Theory-**

Aqua cultural project layout and planning, Types of pond and their design, Determination of earthwork volume, Source of water and pumping devices, Surface and subsurface flow schemes for water supply, Design of channels, Design of drainage system for aqua cultural farms, Design of monk and their construction procedure, Formulation of mathematical models for different aqua cultural operations, Design of earthen and cemented fish raceways with and without water recirculatory system, Functional design of biological and mechanical filters, Design of fish ladders and fish lifts, Design of aeration equipment for aqua cultural ponds.

Practicals

Biochemical analysis of pond water; Performance testing of aqua cultural machinery; Design of fish tanks for specific conditions including the earthwork and costing; Studies on effect of microclimatic parameters on fish and the analysis of data; Development of decision support systems for different aqua cultural production systems; Storage and packaging of fish and fish products

CAF-IDE-476**MODELING IN WATER RESOURCES****3 (2+1)****Theory**

Modeling concept of water resources systems, Lumped and distributed models, physical or conceptual models, deterministic and stochastic models in water resources, simulation, optimization and simulation-optimization models for the planning and management of water resources systems, model calibration, validation and sensitivity analysis

Modeling for representing/estimating/predicting/simulating evapotranspiration, precipitation, infiltration, stream flow/runoff, base flow, hydrograph, soil water, plant growth, ground water flow, Modeling for irrigation scheduling, land and water allocation, river basin management, command area management, modeling for groundwater pollution, solute transport

Practicals

Exercise and case studies for planning, optimization, management and operation of water resource systems; Study of spread sheet models; Study of HEC-HMS model; Study of RIBASIM model; Study of MIKE BASIN model; Study of MIKE SHE model; Study of CROPWAT model; Study of SWAT model; Study of MATLAB model; Study of MODFLOW model; Study of VISUAL MODFLOW model.

FERTIGATION AND ENVIRONMENT CONTROL FOR PROTECTIVE CULTIVATION**Theory-**

Introduction – History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polysheds /shed nets, Cladding materials, Plant environment interactions – principles of limiting factors, solar radiation and transpiration, greenhouse effect, light, temperature, relative humidity, carbon dioxide enrichment, Design and construction of green houses – site selection, orientation, design, construction, design for ventilation requirement using exhaust fan system, selection of equipment, Greenhouse cooling system – necessity, methods – ventilation with roof and side ventilators, evaporative cooling, different shading material fogging, combined fogging and fan-pad cooling system, design of cooling system, maintenance of cooling and ventilation systems, pad care etc. Greenhouse heating – necessity, components, methods, design of heating system.

Root media – types – soil and soil less media, composition, estimation, preparation and disinfection, bed preparation. Planting techniques in green house cultivation. Irrigation in greenhouse and net house – Water quality, types of irrigation system, components, design, installation and material requirement Fogging system for greenhouses and net houses – introduction, benefits, design, installation and material requirement. Maintenance of irrigation and fogging systems Fertilization – nutrient deficiency symptoms and functions of essential nutrient elements, principles of selection of proper application of fertilizers, fertilizer scheduling, rate of application of fertilizers, methods, automated fertilizer application Greenhouse climate measurement, control and management Insect and disease management in greenhouse and net houses Selection of crops for greenhouse cultivation, major crops in greenhouse – irrigation requirement, fertilizer management, cultivation, harvesting and post harvest techniques; Economics analysis.

Practicals-

Estimation of material requirement for construction of greenhouse ; Determination of fertilization schedule and rate of application for various crops; Estimation of material requirement for preparation of root media; Root media preparation, bed preparation and disinfections; Study of different planting techniques ; Design and installation of irrigation system ; Design and installation of fogging system ; Greenhouse heating; Study of different greenhouse environment control instruments; Study of operation maintenance and fault detection in irrigation system; Study of operation maintenance and fault detection in fogging system; Economic analysis of greenhouses and net houses; Visit to greenhouses

CAF-IDE-478 PRECISION FARMING TECHNIQUE**3 (2+1)****Theory**

Precision Farming: Concept of precision farming, components, scope, PF under different farming situations, adoption of PF technologies, problems in PF, equipments needed for PF, potential of PF in India. Role of RS and GIS in PF: Definition of RS & GIS, Role of RS & GIS in precision farming, steps in PF: Inventory crops on farm water management, pest detection and management, yield assessment, soil health detection. Soil properties: Soil physical/chemical properties, soil texture, soil structure, density of soil, pore space, soil consistency, soil colour, infiltration, SAR, EC, PH. land infiltration, soil resource database, soil information system digital spatial database. Site specific nutrient management, sample collection, grid development uniformity in sample collection, analysis and nutrient management plan, objectives of site specific management, importance of nutrient management, benefits of Site specific management Land preparation: Agricultural operations, types of tillage, conventional minimum tillage, reduced tillage, conservation, zero, rotary ridge. Planting techniques: Planting system: FIRB planting system, surface seeding, and their importance, and planting /sowing mulching Planting planning, layout selection of site, preliminary operations, systems of planting, rectangular, square, diagonal, hexagonal, triangular and contour system Fertigation and irrigation: Criteria for fertigation, Application of fertilizers: Nitrogen

application, phosphorus application, potassium application, micro-nutrients application. Effect of fertigation on crops. Advantages of fertigation, limitations of fertigation, constraints of fertigation, equipment and methods for fertilizer injection: fertigation injection system, pressure differential injection system, venturi injection system. Pest and disease management. Pest and disease management: Pesticide application, role of pesticide application, choice of pesticides, formulation application and factor affecting pesticide application case studies for major crops.

Practicals

Determination physical properties of soil; Determination chemical properties of soil; Determination chemical properties of water; Determination of N, P and K; Study of different fertilizer applicators; Design of micro-irrigation system; To work out the material requirement of micro-irrigation for specific crop; Installation of Micro-irrigation system; Case studies on spot land tillage and preparation of layout for different crops and planting; Visit to RS and GIS center; Visit to processing industries; Visit to Packaging industries

CAF-IDE-479

WATER RESOURCES SYSTEM ENGINEERING

3 (2+1)

Theory

Techniques for optimization of water resources: classical optimization techniques- linear programming, non linear programming, integer programming, quadratic programming and dynamic programming; Evolutionary algorithms for optimization: genetic algorithm, practical swarm optimization, ant colony optimization; Uncertainty analysis in water resources, chance constrained programming, implicit and explicit stochastic optimization; fuzzy logic and fuzzy based systems, Monte Carlo Simulations, Risk assessment and analysis, Expert systems; Multi objective optimization; Analytical hierarchical process; Artificial neural network, simulated annealing

Practicals

The case studies for optimization of land and water resources on basin and command area levels using linear programming; The case studies for optimization of land and water resources on basin and command area levels using non-linear programming The case studies for optimization of land and water resources on basin and command area levels using integer programming The case studies for optimization of land and water resources on basin and command area levels using quadratic programming; The case studies for optimization of land and water resources on basin and command area levels using dynamic programming; Evolutionary algorithms; Case studies on multi-objective optimization; Risk assessment and uncertainty analysis of water resources systems.

CAF-IDE-4710 GROUNDWATER POLLUTION AND CONTROL

3 (2+1)

Theory

Impurities in ground water, Physical, chemical and bacteriological characteristics of ground water, indices of water quality for domestic, agricultural and industrial uses, water quality standards, Monitoring of water quality, Sources of ground water pollution and their control measures. Modeling studies in ground water pollution, Pollution control and their enforcement mechanism, Unit operations and wastewater treatment kinetics, Pollutant uptake by plants, mining of groundwater, sea water intrusion.

Practicals

Determination of dissolved and suspended impurities in ground water; Bacteriological test of water; Testing for fitness in irrigation water; Estimation of consequent changes in soil quality due to irrigation by varying water quality; Estimation of leaching requirement of cropped land; Physical filtration of impure water in pressurized irrigation system; Analysis of industrial effluent water quality and interpreting suitability for its use in irrigation



Factors affecting shelf life of food material during storage; spoilage mechanism during storage; definition, requirement, importance and scope of packaging of foods; types and classification of packaging system; advantage of modern packaging system. Different types of packaging materials used. Different forms of packaging, metal container, glass container, plastic container, flexible films, shrink packaging, vacuum & gas packaging. Packaging requirement & their selection for the raw & processed foods. Advantages & disadvantages of these packaging materials; effect of these materials on packed commodities, Package testing, Printing, labeling and lamination. Economics of packaging; performance evaluation of different methods of packaging food products; their merits and demerits; scope for improvements; disposal and recycle of packaging waste.

Practical:

Identification of different types of packaging materials; Study of tensile strength of package material; Study of compressive strength of given package; To study of different destructive tests for glass containers; To study of non-destructive tests for glass containers; Vacuum packaging of agricultural produces; Study of tearing strength test of paper board; measurement of thickness of packaging materials; To study of grease-resistance test in plastic pouches; Study of bursting strength of packaging material; Study of water-vapour transmission rate; Shrink wrapping of various horticultural produce; Study of testing of chemical resistance of packaging materials; Study of drop test of food package; Visit to Indian Institute of Packaging, Mumbai and relevant food packaging industries.

2 CAF- APE 472 **Development of Process Products and Equipments** 2 + 1 = 3

Applications of unit operations to the food industry, analytical processing concepts with regards to mass and energy balances, equipment involved in the commercially important food processing methods and unit operations; value addition to cereals like rice, wheat etc. Quality of processed products of rice & wheat. Processing of pulses, spices and condiments; fermented food product, frozen and dried products. Technology of oilseeds and fat products, snack foods, Fruits and vegetables products: candy, nutraceuticals. Food product development trends, food additives and labeling. Process equipment for thermal processing - evaporation, dehydration, drying, blanching, pasteurization, distillation; mechanical separation-filtration, sieving, centrifugation, sedimentation; mechanical handling-conveying and elevation; size reduction and classification-mixing; kneading, blending.

Practical

Study of different cleaners and graders used in agro processing industries; planning and layout of roller wheat flour milling ; visit to milk plant; visit to roller flour mill; visit to different canning units; visit to fruit/vegetable processing plants; flow process diagram and study of various models of the machines used in a sugar mill.

3 CAF- APE 473 **Food Processing Plant Design and Layout** 2 + 1 = 3

Plant layout – meaning, definition, objectives, principles and types. Salient features of processing plants for cereals, pulses, oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products. Site selection criteria, selection of processes, plant capacity, project design, flow diagrams, selection of equipments, process and controls, handling equipments, plant layout, Plant elevation, requirement of plant building and its components, labour requirement, plant installation, power and power transmission, sanitation. Cost analysis. Feasibility project report.

Practical

Planning, visit and layout of flour milling plant; Planning, visit and layout of rice milling plant; Planning, visit and layout of milk plant; Planning, visit and layout of bakery plant; Planning, visit and layout of fruits and vegetable dehydration plant; Planning, visit and layout of beverages industry; Planning, visit and layout of edible oil extraction plant; Planning, visit and layout of ice-cream plant; Planning, visit and layout of sugar mill plant; Planning, visit and layout of honey/turmeric/chillies processing plant. Preparation of feasibility report of food processing plant.

4 CAF- APE 474

Rice Process Engineering 2 + 1 = 3

Rice processing industry in India. Paddy grain - structure, chemical composition, physical properties, thermal properties and aerodynamic properties. Drying of paddy - Baffle dryers, L.S.U. dryers, R.P.E.C. dryers. Parboiling of paddy – Principles and influence on quality. Methods of parboiling. Milling of paddy – Conventional and modern methods. Machines – Hullers, under runner disc sheller, centrifugal sheller. Modern Rice Milling technology – unit operations, cleaning, milling, polishing and grading machines. Products and By-products of modern rice mills. Utilization of rice-mill by-products. Processed foods from rice – Break fast, cereals, flakes, puffing, instant rice etc.

Practical

Determination of moisture content of paddy. Determination of Physical properties of rice, Determination of milling qualities of rice, Determination of cooking qualities of rice, Study of Pre-cleaner, Study of Rubber Roll Sheller and Husk aspirator, Study of Paddy Separator, Study of Rice Polisher, Study of Rice Grader. Visit to Modern Rice Mill, Puffing units, and Flaking units.

5 CAF- APE 475

Seed Process Engineering 2 + 1 = 3

Seed processing industry - status and prospectus. Unit seed processing operations, Study of physical characteristics of seed for separation. Seed processing machineries. Planning and layout of seed processing plant. Seed cleaning, grading and separation machineries. Seed treatments, packaging and storage. Seed Testing. Seed Standards and seed certification. Seed marketing and distribution.

Practical

Determination of seed moisture content. Study of pre-cleaners. Study of air screen cleaner-cum-grader. Study of debearder. Study of indented cylinder separator. Study of specific gravity separator. Study of spiral separator. Study of seed treater. Study of seed bagging and labeling. Seed sample testing (physical purity and germination.). Study of bucket elevator. Study of cotton delinting machinery. Estimation of processing cost, Visit to seed processing plant /Ware house, Study of seed storage. Process flow diagram for processing of different grain crops.

Composition and Nutritional Value of Horticultural Crops. Physiological development and maturity, compositional changes, physiological break down and control measures. Product maturation and maturity indices. Preparation of Fruits and Vegetables for fresh market. Post harvest handling operations. Cooling of horticultural commodities- need, changes, methods. Packages - requirement and economic considerations. Low temperatures and physiological disorders. Quality - components , factors influencing quality , evaluation and standards for fresh fruits and vegetables. Storage atmosphere – CO₂, Ethylene, microbial growth. Modified atmosphere during transport and storage. Cold storages and controlled atmosphere storages. Storage deterioration – Biological and environmental factors.

Practical

Study of maturing indices. Study of respiration quotient. Study of pre cooling of fruits and vegetables. Study of blanching of Vegetables. Study of wax coating of fruits. Study on use of chemicals for ripening and enhancing shelf life of fruits and vegetables. Study of storage systems. Study on packaging of fruits and vegetables. Determination of mechanical damage during handling and transport of fresh fruits and vegetables. Studies on chilling injury and physiological disorders. Visit to commercial pack house. Visit to commercial cold storage units.

Extrusion processing - importance, principles of extrusion cooking, methods of extrusion cooking. Extruders; Types of extruders, single screw, twin screw their applications, Extruded products. Thermal processing microbial inactivation rate, lethality, D-value. Thermal Processes and equipments. Membrane concentration - theory, equipment and applications. Freeze concentration process and equipment. Advances in freezing - methods and equipment. Drying of liquid foods. Freeze drying-principles and equipment. Aseptic processing. Microwave heating.

Practical

Study on heat penetration characteristics of conduction and convection heated food materials and computation of lethality of the process using heat penetration curve, Study on osmotic dehydration of selected fruits, Study of type of food extruders, Preparation of extruded products, Performance evaluation of a membrane separation process, Freezing time calculations using various methods, Visits to processed food industries.

Meat and poultry industries in India. Kinds of meat animals and poultry birds; pre-slaughter care, methods of stunning. Slaughtering; Dressing of meat and poultry - post slaughter care and post mortem inspection. Classification and quality of meat - Aging, curing, smoking, canning and irradiation. Preservation of meat-curing agents and additives, meat products, formed and sectioned meat, sausage products; Hygiene and sanitary conditions in a meat processing plant . Formation, structure, chemical composition and nutritive value of eggs; Collection, handling, grading and quality parameters of eggs; Method of preservation of egg and their products; Spoilage of egg and their products, Hygiene and sanitation - regulations.

PRACTICAL

Wholesale and retail sale cuts of meat animals and poultry birds. Slaughtering and dressing of goat and poultry birds. Ante-mortem and Post-mortem inspection of meat. Measurement of meat tenderness. Curing of meat. Preparation of products from meat. Experiments on External and Internal quality parameters of eggs. Visit to slaughter houses. Visit to poultry processing units. Visit to meat processing units.

9 CAF-APE 479

Bio process Engineering 2 + 1 = 3

Bio- process engineering – introduction. Microbial diversity, Prokaryotes and Eucaryotes. Cell construction and nutrients. Growth of cells, kinetics, Stoichiometry of microbial growth. Fermentation – theory, food fermentation, ethanolic fermentations, alcoholic-acid fermentations, equipments. Enzymes – theory, production and uses in food industry. Bioreactors, selection operation, and uses. Purification and recovery of products. Bioreactors of suspension culture . Bioreactors for organize tissues. Process decision and constraints. Mix cultures and utilization in food industry. Biological waste treatment and industrial bioprocesses.

Practical-

Preparation and inoculation of PDA medium and harvesting, Preparation and inoculation of YPSS medium and harvesting, Preparation and inoculation of wheat bran medium, Harvesting, recovery and purification of enzymes, Characterization and measurement of enzyme activity, Enzyme treatment of oilseeds and its effect on oil yield, Studies on the performance of batch and microprocessor controlled Fermentors. Visit to fermentation plants and wine making plants.

10 CAF-APE 4710

Food safety, standards and Laws 2 + 1 = 3

Food Laws and Regulations in India. Scope and need of food laws and standards. Types of laws, Mandatory and voluntary food laws. Food grades and standards BIS, AGMARK, PFA, FPO, CAC (Codex Alimentarius Commission), EUREPGAP, GMP, HACCP, ISO 9000 and 22000 Series. Other Mandatory acts. Essential commodity act, Consumer protection act, Environmental protection act, Export (quality control & inspection) act. Various food orders; Fruit product order, Milk & Milk product order, plant food seed (Regulation of imports in India) order, edible oil package order meat food products order. General principles to be followed in safety and analysis of food. Sanitation in food industry. Food inspector, duties of Food inspectors. The food safety and standards bill. Recommended international code of hygiene for various products.

Practical:

Study and Examination of processed food in relation to FPO & BIS specifications. Study and Examination of Ghee for AGMARK. Study and Examination of honey for AGMARK and BIS standards. Examination of spices for AGMARK & BIS standards. Study and Examination of milk & Milk products for MMPO. Study and Examination of fruit processed products (jam, ketchup, jelly and squashes) for prescribed food standards. Visit to quality control laboratory of Food processing industries.

11 CAF-APE 4711

Baking Technology 2 + 1 = 3

Food grain - structure, composition; Milling Technology - Dry and wet milling; Flour - quality, testing and uses; Dough rheology – equipments, Baking - principles, products and Machinery; Technology for Bread, biscuits and cookies making; Pasta processing; Breakfast cereals processing; Malting - process, operation and uses; Cereal based baking products; Packaging of baked products.

Practical -

Study of grain structure; Determination of grain moisture content by hot air oven method; Determination of proximate composition of grains; Study of dry milling of food grains; Study of wet milling of food grains; Study of flour quality and its testing; Study of physical characteristics of dough; Preparation of breads; Preparation of biscuits; Preparation of pasta; Preparation of breakfast cereals; study of malting of food grains; Preparation of cereal based domestic products; Visit to bakery, pasta, breakfast cereals manufacturing industries.



CAFETERIA COURSES

Course no: CAF-FMP-471

Title: Tractor Design and Testing

Sem: VII

Credit: 3 (2+1)

Theory:

Procedure for design and development of agricultural tractor, Study of parameters for balanced design of tractor for stability & weight distribution, hydraulic lift and hitch system design. Design of mechanical power transmission in agricultural tractors. Design of Ackerman Steering and tractor hydraulic systems. Study of special design features of tractor engines and their selection. Design of seat and controls of an agricultural tractor. Tractor Testing.

Practical: Design problem of tractor clutch – (Single/ Multiple disc clutch); Design problem on spur gears; Design problem of bevel gears; Design problem of helical gears; Design of gear box(synchromesh/constant mesh); Design of variable speed constant mesh drive; Selection of tractor tires – Problem solving; Problem on design of governor; Problem related to selection of hydraulic pump; Engine testing as per BIS code – various test; Drawbar performance in the lab; PTO test and measure the tractor power in the lab/field; Determining the turning space, turning radius and brake test, hydraulic pump performance test and air cleaner and noise measurement test; Visit to tractor testing centre/industry.

Course no: CAF-FMP-472

Title: Hydraulic Drives and Controls

Sem: VII

Credit: 3(2+1)

Theory:

Hydraulic Basics: Pascal's Law, Flow, Energy, Work, and Power. Hydraulic Systems, Color Coding, Reservoirs, Strainers and Filters, Filtering Material and Elements. Accumulators, Pressure Gauges and Volume Meters, Hydraulic Circuit, Fittings and Connectors. Pumps, Pump Classifications, Performance, Displacement, Designs, Gear Pumps, Vane Pumps, Piston Pumps, Pump Operation. Hydraulic Actuators, Cylinders, Construction and Applications, Maintenance, Hydraulic Motors. Valves, Pressure-Control Valves, Directional- Control Valves, Flow-Control Valves, Valve. Installation, Valve Failures and Remedies, Valve Assembly, Troubleshooting Valves Hydraulic Circuit Diagrams and Troubleshooting, United States of American Standards Institute USASI Graphical Symbols Tractor hydraulics, nudging system, ADDC. Pneumatics: Air services, logic units, Fail safe and safety systems Robotics: Use of Hydraulics and Pneumatics drives in agricultural systems, PLCs (Programmable Logic Controls).

Practical: Introduction to Hydraulic Systems; Study of Hydraulic Pumps; Study of Hydraulic Actuators; Study of Hydraulic Motors; Study of Hydraulic Valves; Hydraulic codes and circuits; Building simple Hydraulic Circuits; Hydraulics in Tractors; Introduction to Pneumatics; Pneumatics Devices; Pneumatics in Agriculture; Use of Hydraulics and Pneumatics for Robotics.

Course no: CAF-FMP-473
Management

Title: Farm Power & Machinery

Sem: VII

Credit: 3(2+1)

Theory:

The role of mechanization and its relationship to productivity, employment, social and technological change; performance and power analysis; cost analysis of machinery: fixed cost and variable costs, effect of inflation on cost; selection of optimum machinery and replacement criteria; Break-even analysis, reliability and cash flow problems; mechanization planning; case studies of agricultural mechanization in India.

Practical: Solving problems related to Various capacities, pattern efficiency, system limitation, power requirement and other operational parameters; Solving of Problems related to cost analysis and inflation; Solving problem related to selection of equipment, replacement, break-even analysis, time value of money etc.; Presentation of seminar on topic assigned related to farm machinery management; Design of farm mechanization plan for different farm size and cropping pattern.

Course no: CAF-FMP-474

Title: Human Engineering and Safety

Sem: VII

Credit: 3(2+1)

Theory:

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. Speech communications. Biomechanics of motion, types of movements, Range of movements, strength and endurance, speed and accuracy, human control of systems. Human motor activities, controls, tools and related devices. Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution. Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

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

Course no: CAF-FMP-475 Title: Production Technology of Agricultural Machinery

Sem: VII

Credit: 3 (2+1)

Theory:

Critical appraisal in production of Agricultural Machinery; Modeling and stress analysis of Machinery parts by using standard software; Advances in material used for tractor & Agril. Machinery. Cutting tools including CNC tools and finishing tools. Advanced manufacturing techniques like powder metallurgy, EDM (Electro-Discharge Machining), Heat Treatment of steels including pack carburizing, shot pining process, chemical vapor deposition (CVD) etc. Limits, Fits & Tolerances, Jigs & Fixtures, Microstructure Analysis. Industrial lay-out planning, Quality management,. Economics of process selection. Techno-economic feasibility of Project Report. Selection of Standard/ critical components. Case studies of manufacturing of agril. machinery. Servo motors, drives & controllers, CNC controllers for machine tools. CNC programming. Assembly and plant automation. Storage and transportation.

Practical: To draw an exhaustive design plan for a machine & describe its kinematics; Part modelling of agril. machinery by using standard software; Problem on design of cultivator and drill parts; Problem on design of sprayer parts and fluid flow; Problem on design of harvesting and threshing machinery parts; Visit to Central Tool Room/ Industry with Advanced manufacturing techniques; Jigs and Fixtures – study in relation to Agril Machinery; Design problems on fits, tolerances and limits; Layout planning of a small scale industry; Problem on Economics of process selection; Preparation of a project report; Case study for manufacturing of weeder / thresher through industry visit; Study of different CNC controllers/ servo motors; CNC programming; Case studies for manufacturing of tractor through industry visit

Course no: CAF-FMP-476

Title: Mechanics of Tillage and Traction

Sem: VII

Credit: 3(2+1)

Theory:

Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship, design of tillage tools principles of soil cutting, design equation, force analysis, application of dimensional analysis in soil dynamics performance of tillage tools. Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction, tyre size, tyre lug geometry and their effects, tyre testing, soil compaction and plant growth, variability and geo statistic, application of GIS in soil dynamics.

Practical: Measurement of static and dynamic soil parameters related to tillage;

Measurement of soil parameters related to puddling and floatation; Measurement of draft for passive rotary and oscillating tools; Measurement of slip and sinkage under dry and wet soil conditions; Measurement of load and fuel consumption for different farm operations; Economics of weight transfer and tractor loading including placement and traction aids; Studies on tyres, tracks and treads under different conditions; Studies on compaction and number of operations.

Course no: CAF-FMP-477

Title: CAD of Agricultural Machines

Sem: VII

Credit: 3 (2+1)

Theory:

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. Graphic primitives, display file, frame buffer, display control, display processors, Line generation, graphics software. Points and lines, Polygons, filling of polygons. Text primitive. Other primitives. Windowing and clipping, view port. Homogeneous coordinates. Transformations. Planar and space curves design. Analytical and synthetic approaches. Parametric and implicit equations. B-spline and Beizer curves. Geometric modeling techniques. Wire frames. Introduction to solid modeling. Introduction to numerical control, basic components of NC system, NC coordinates and motion control systems. Computer numerical control, direct numerical control, combined CNC/DNC. NC machine tools and control units. Tooling for NC machines, part programming, punched tape, tape coding and format, manual and computer assisted part programming.

Practical: Preparation of drawings with dimensions from Models and Isometric drawings of objects and machine components; Preparation of sectional drawings of simple machine parts; Drawing of riveted joints and thread fasteners; Demonstration on computer graphics and computer aided drafting use of standard software; Practice in the use of basic and drawing commands on auto cad; Generating simple 2-D drawings with dimensioning using AutoCAD; Practice in the use of modify and rebelling commands; Practice in graphics mathematics, curve fitting and transformations; Demonstration on CNC machine.

Course no: CAF-FMP-478

Title: Farm Machinery Design

Sem: VII

Credit: 3(2+1)

Theory:

Material of construction of farm machinery & their properties, Design of power transmission components and system in agril. Machines, fit & tolerances. Design parameters of Agril. implements, Force analysis of primary tillage tools and their hitching systems, Design considerations of Reapers, Mowers, Harvesters and threshing equipments. Application of design method to the system of selected farm machinery, Cost estimation of designed machinery.

Practical:

Power transmission, their components and designs. Fit and tolerances to be used in agril. Machine design. Design parameters related to crop, soil and machinery. Force analysis of tillage& other machineries - Design consideration of seed drills /planters, inter culture tools, reaper/mower/ harvester, thresher. Application of computer aided design methods of the selected farm machinery. Cost estimation of Design Machinery.

CAFETERIA COURSES

Course No. : CAF-FS- 471

Title: Estimating, Costing and Contracting

Sem : VII

Credit: 3 (2+1)

Theory:

Approximate methods of costing, types of estimates, necessity of the approximate methods costing, Approximate methods of costing for various structures.

Specification : Principles of specifications writing, typical specifications.

Contracts: Forms of contract, termination of contracts, labor contracts negotiated contracts, schedule of price contracts, responsibility of the engineer, contractor and Owner, Earnest money and security deposit, tender form, unbalanced tender, Liquidated damages, advertisement, contract document, Typical clauses and conditions of contracts.

Taking out quantities :

Methods, modes and units of units of measurement for different trade, Rates for some typical items.

Rate Analysis:

Factors affecting the rate analysis, importance of rate analysis, Schedule of rates, for material and labor, rate analysis of typical items.

Typical estimates: Any Five estimates of septic tank, compound wall, farm buildings, Hume pipe culvert, RCC floor, RCC retaining wall, earthen dam, grain storage structure, Gobar gas plant, water closet (sanitary) well with pump house, farm pond, irrigation channel.

Accounts: Stores, materials at site account, capital work and repair work administrative approval and technical sanction, measurement book, muster roll, completion report, imprest.

Practicals :

To workout the estimate of Dairy barn. To workout the estimate of Poultry / Goat house. To workout the estimate of godowns. To workout the estimate of green house. To workout the estimate of Water Conservation Structures. To workout the estimate of Residential buildings.

Course No. : CAF-FS- 472

Title: GREEN HOUSE TECHNOLOGY

Sem : VII

Credit: 3 (2+1)

Theory:

History ,Development and scope of Green House technology, Green House planning, layout and its construction ,Effect of temperature, R.H. and CO₂ with reference to micro climate in Green House crops. Role of light ,Ventilation ,cooling, Heating in Greenhouse. Techno-economic feasibility ,cost estimation and erection of low cost Green House in the field. Utility of Green House for different crop production.

Covering Material: Maintenance of Green House, Computer application in Green House, irrigation system, fertigation, humidification, inside Green House, pest and disease control in Green House, Post harvest Technology.

Practicals:

History, scope and development of Green House Technology. Study of different types of Green House. To study the components of Green House, their fabrication erection and constructional details. Design of cooling, heating and ventilation system for Green House. Study of Green House Covering materials. Role of CO₂ in Green House. Control of light in Green House. Civil Maintenance of Green House. Maintenance of Green House in relation to light temperature and humidity. Study of economics of crop production under Green House. Visit to Green House in Maharashtra state. Application of computer in Green House management.

Course No. : CAF -FS- 473

Title: Construction Technology

Sem : VII

Credit: 3 (2+1)

Theory:

Foundation, Stone and brick, masonry, floors, walls, Arches, Lintels, roofs and layout,

Drainage and sanitation, Door, Windows, Ventilators, Plastering, Painting, paints, Drawing of buildings, Design and Layout of buildings, Drawing components of Agricultural structure.

Practicals:

To study the different types of foundations. To study the different types of stone and brick masonry. To study the various types of floors. To study the various types of walls. To study the Arches and lintels. To study the different types of roof and their layout. To study the drainage and sanitation arrangement in building. To study the different types of doors, windows and ventilators. Types of plastering, pointing and painting and various types of paints. To study the layout and drawing of buildings. To draw the complete layout, plans and design of Agril. Buildings. To draw the detailed drawing of components of Agril. Structures.

Course No. : CAF -FS- 474**Title: Rural Housing****Sem : VII****Credit: 3 (2+1)****Theory:**

Indigenous building materials, materials of Construction, natural cooling, ventilation, structural components, low cost housing designs, rural community centers, design of family house, dairy barns, cattle sheds, goat house, structural design of well, pump house, distribution chambers.

Practicals:

Survey and identification of indigenous building materials. To study the materials of construction and alternatives for economizing the construction. Studies on natural cooling and ventilation. Standardization of structural components. Study of low cost housing designs advocated by different agencies. Rural community centers and utilities. Design and estimation of small family house/ barns/cattle sheds and goat house. Structural details of well, pump house, distribution chambers.

CAFETERIA COURSES

Course No: CAF-EOES -471	Semester:
Title: Waste and By-Product Utilization	Credits : 3(2+1)

Theory:

Types and formation of byproducts and waste; magnitude of waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues, 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, 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, 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; and biogas generation.

Practical:

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

Course No: CAF-EOES -472	Semester:
Title: Renewable Energy Technologies	Credits : 3 (2+1)

Theory:

Design and operational parameters, performance evaluation and maintenance aspects of different renewable technologies like gasifiers, biogas plants, solar passive heating devices, photovoltaic cells and arrays, briquetting machines and balers; bio-diesel utilization in CI engines.

Practical:

Performance evaluation of solar water heater; Performance evaluation of solar cooker; Characteristics of solar photovoltaic panel; Evaluation of solar air heater/dryer; Performance evaluation of a rice husk throatless gasifier engine system; Performance evaluation of down draft gasifier with throat for thermal application; Performance evaluation of a fixed dome type biogas plant; Performance evaluation of floating drums type biogas plant; Estimation of calorific value of producer gas; Testing of diesel engine operation using biodiesel; Evaluation of briquette machine using biomass material; Evaluation of rice straw briquette.

Course No: CAF-EOES -473	Semester:
Title: Control Engineering in Agriculture	Credits : 3 (2+1)

Theory:

Introduction to control system, feedback and feed-forward control systems, block diagrams, Laplace and inverse Laplace transforms, mathematical models of physical systems, structured modeling (Bond Graph modeling), transfer function, steady state analysis, state variable characterization dynamics of first and second order systems, electronic paramatic and hydraulic control system and their appliances to farm machinery, food process industry, aquaculture and milk processing plants. Mode of control and generations of control actions, P, PI and PHD controllers, final control elements and valve positioners, frequency response and root locus analysis, Nyquist stability criterion, stability and quality of overall control system, digital control. Electronic, pneumatic and hydraulic control systems, and their applications to farm machinery, food processing industry, aquaculture and milk processing plants.

Practicals:

Study of generalized control systems.,Static calibration of flapper nozzle assembly.Calibration of pneumatic P,PI and PID controllersStudy and calibration of control valves.Cascade control of flow and level/flow and temperature.Visits to different plants for instrumentation and controls.Study of hydraulic, mechanical/electronic controllers.

Course No: CAF-EOES -474	Semester:
Title: Utilization of electrical energy in agriculture	Credits : 3 (2+1)

Theory:

Motor characteristics, standards, ratings and selection of motors, Duty cycles and efficiency. Electrical heating, Welding charging of batteries. Cost of electricity energy audit, effect of power factors, renewable electrical energy devices. Special electrical appliances and controls use for dairy, poultry, processing and irrigation system. Selection of electrical motors for different farm operations.

Practicals:

Study of electrical lighting, heating and welding systems, Study and survey of electrical equipments used in dairy, poultry and livestock farming. Tracing of faults in electrical wiring and winding. Design and preparing layout of farm electrical distribution system. Study of electrical energy auditing Tarrif and conservation of electrical energy on farm, Study of renewable electrical energy system. Study of Charging of Batteries, Study of PF improver & controls (single phasing earthing. Electrical energy use in Processing and Irrigation.

Course No: CAF-EOES -475	Semester:
Title: Energy Conservation and Management in Agriculture	Credits : 3 (2+1)

Theory:

Classification of energy on the basis of sources, Agricultural energy inputs and their energy values, Energy audit, selection of villages & classification of agricultural farms, classification of data availability on power and energy requirements for various filed operations, operational cost from various power sources for different agro climatic zones crop grown energy analysis in crop production in various farming systems for rabbi, kharif and summer crops, comparison on energy utilization pattern for major crop production, Energy requirement in different agro based industries, energy conversion systems, energy systems in Green houses and passive architecture, energy environment and economics consideration, New sources of energy.

Practicals: To study Agricultural Energy sources input categorization and energy equivalent, To study accounting energy in Farm Machinery and welding, To study Agricultural Energy sources input categorization and energy equivalent, To study energy required for irrigation, To study energy inputs in crop production. To study Agriculture energy relationship, To study the energy requirements for different agro processing operations, To study the energy conserving methods (Appropriate Technology), Field visits on farm & industries on energy utilization aspects, Minor project on energy analysis for crop productions processed products.

Course No: CAF-EOES -476	Semester:
Title: Data Base Management and Mirco-processor Application	Credits : 3 (2+1)

Theory:

Data structures, records and files, fixed and available length records, sorting, merging, searching and hushing techniques. Differ and buffer management. Bulk storage devices and file management systems, sequential and direct success devices, indexing, data manipulation language, data security, introduction to microprocessor, architecture of 8,16 and 32 bit microprocessors, assembly language of 8085, Micro controllers; data converters. Application of microprocessors to process control and instrumentation.

Practicals:

Introduction of dBase 3+(data structure, field records, files),To create a data base file using dBase 3+Sorting and indexing records.Merge the data base files,.Study of the Differ and Buffer management,Study of the file management system,Study the bulk/sequential and direct access devices,Introduction to 8085 micro processor (8.16 and 32),Assembly language programme I,Assembly language programme II,Study of data lowers single channel, multi channel.,Data equation and multi plexing,Study the application of micro processors to processor control and instrumentation viz. Temperature, flow, torque, speed RH etc.

CAFETERIA COURSES

Course No. : CAF- SWCE – 471 Title: Gulley and Ravine Control Structures
Sem : VII Credit: 3 (2+1)

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; Statistics in hydrology, flood frequency methods - Log normal, Gumbel' s extreme value, Log-Pearson type-III distribution; depth-area-duration analysis; flood forecasting, flood routing – channel routing, Muskingum method, reservoir routing, modified Pul' s method; flood control - history of flood control, structural and non-structural methods of flood control measures, storage and detention reservoirs, levees, channel improvement; Gulley erosion and its control; soil erosion and sediment control measures; river training works, planning of flood control projects and their economics.

Practical: Determination of flood stage-discharge relationship in a watershed; determination of flood peak-area relationships. Determination of frequency distribution functions for extreme flood values using Gumbel' s method; Determination of frequency distribution functions for extreme flood values using log-Pearson Type-III distribution; Determination of confidence limits of the flood peak estimates for Gumbel' s extreme value distribution; Determination of probable maximum flood; Standard project flood and spillway design flood; Design of levees for flood control; Design of jetties; Study of vegetative and structural measures for Gulley stabilization; Designing and planning of a flood control project; Cost and benefit analysis of a flood control project.

Course No. : CAF- SWCE – 472 Title: Reservoir and Farm Pond Design
Sem : VII Credit: 3 (2+1)

Earthen embankments - functions, advantages and disadvantages, classification – hydraulic fill and rolled fill dams - homogeneous, zoned and diaphragm type; foundation requirements, grouting, 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; design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc; stability of slopes - analysis of failure by slice method; types of reservoirs and farm ponds, design and estimation of earth work; cost analysis.

Practical: Study of different types and materials of earthen dams; Determination of the position of phreatic line in earth dams for various conditions; Stability analysis of earthen dams against head water pressure; Stability analysis of earthen dams against foundation shear; Stability analysis of earth dams against sudden draw down condition; Stability of slopes of earth dams by friction circle method / different methods; construction of flow net for isotropic and anisotropic medium; Computation of seepage by different methods; determination of settlement of earth dam; Input-output-storage relationships by reservoir routing; design of farm ponds; cost estimation of farm ponds and other structures.

Course No: CAF-SWCE-473

Semester: VII

Credit: 3(2+1)

Title: Computer Application in Soil and Water Conservation Engineering

Theory : Modeling:-Concept, Development, Types; Simulation Modeling:- Definition and Application; Model Development:- Phases and steps; Programming Languages for Models development;- Introduction; Necessity of application of Model in Natural resources Management; Various models available for natural resources management; Different softwares and models used in soil and water conservation engineering.

Practical:

Study and use of hydrological calculator; Design of soil and water conservation structures by using different softwares; Study of CROPWAT and its applicability; Study of IWLIS software and its applicability, Study of Didger software and its applicability; Study of Watershed Soft Guide and its applicability; Study of A to Z software and its applicability.

Course No: CAF-SWCE-474

Semester: VII

Credit: 3(2+1)

Title: Remote Sensing and GIS Application in natural resources management

Remote Sensing: Definition, conventional aerial photography , modern remote sensing technology, image interpretation, factors governing the quality of an image; factors governing interpretability, visibility of objects, elements of image interpretation, techniques of 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. GIS: definition, basic components, and standard GI packages; data-entry, storage and maintenance; data types, data structure, 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.

Course No: CAF-SWCE-476 Title: Advance Surface Hydrology

Semester: VII

Credit: 3(2+1)

Theory:

Measurement and Analysis of precipitation data, Precipitation Variability, Meteorological Homogeneity, Design of Rain gauge Networks, consistency of Rainfall records, filling of Missing records, Extension of a Point- Rainfall records, Mean Area Precipitation, Graphical Representation of Rainfall data.

Hydrologic Losses: Evaporation process, lake effect , application of evaporation in Hydrology, measurement of evaporation, Determination of evaporation from water surfaces, transpiration, measurement of transpiration, Evapotranspiration , measurement of evapotranspiration, Estimation of evapotranspiration, interception, factors affecting interception, estimation of interception, depression storage, factors affecting depression storage, infiltration, ϕ and W - indices, f-curve for small watersheds.

Stream flow hydrograph: Components of a hydrograph, factors affecting hydrograph, characteristics, Base flow separation, complex hydrograph, effective rainfall.

Precipitation Runoff Relation : Estimation of surface runoff volume, unit Hydrograph method, Empirical synthesis of unit hydrograph, Conceptual models of unit hydrograph, Estimation peak Discharge, Reservoir flow routing Channel flow routing ,Watershed simulation Stream flow simulation.

Practical

Checking the consistency of rainfall data by double mass curve , Study of various methods for extension of point rainfall record (Station, year, Average, Normal ratio and NWs Method) , Graphical representation of rainfall data by chronological charts and moving averages, Estimation of evapotranspiration by Blancy Criddle, Modified Penman and Hargreaves and Samani Methods, Determination of ϕ and W indices, Study of water balance method in a watershed, Development of DRH from complex hydrograph, Development of UH from DRH, To develop total runoff hydrograph from given UH, Changing UH duration by S-curve method, Hydrologic channel routing by Muskingham method, Study of watershed simulation models.

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