

Course Curriculum of
B.Tech. Agricultural Engineering
Faculty of Engineering, DEI, Agra

Presented to

Academic Council
On 24-05-2022

Recommendations of Curriculum Development Committee

A committee of following members was formed in Academic Council meeting held on 12 July 2021, to modify course curriculum of B.Tech.

Agricultural Engineering

- Shri Rajiv Sinha
- Prof. V. Soamidas
- Prof. A. K. Saxena
- Prof. S. K. Gaur
- Dr. Rajiv Ranjan
- Dr. Ankit Sahai
- Dr. Ashok Yadav

- The modified curriculum with the approval of the internal members of the committee was sent to Shri Rajiv Sinha.

B.Tech. Agricultural Engineering

Course Curriculum

Recommendation of Curriculum Development Committee

The internal members of the committee have given their inputs in finalizing the course curriculum (II, III and IV year) as desired by the Academic council. The revised curriculum proposed by the committee for BTech Agricultural Engineering is attached herewith.


The following modifications are made in the curriculum.

From fifth semester onward, three specializations in the course curriculum are offered to the students.

1. Mainstream Agricultural Engineering
2. Dairy Engineering Specialization
3. Agritech and Entrepreneurship Specialization

The curriculum includes farm machinery and equipment, irrigation, renewables, Agritech, PHE, and logistics etc keeping in mind the small and medium scale farming in our country.

With these specializations from fifth to eighth semesters, the course curriculum is prepared and attached to seek the comments of Shri Rajiv Sinha Ji. Afterward, it will put in the Board of Studies, Agricultural Engineering and finally to Academic Council of the Institute for the approval.


 Prof V Soamidas


Prof A K Saxena


Dr Rajiv Ranjan


Prof S K Gaur


Dr Ankit Sahai


01/02/2022
Dr Ashok Yadav
Co-ordinator

Minutes of meeting with external expert, Shri Rajiv Sinha

Suggestions	Response
The syllabus should include:	
How to increase farm productivity	Incorporated in AEM705
How to increase nutrient use efficiency	Incorporated in AEM822
Innovation in farm equipment specially for small and medium farming. Students should be given projects	Added in AEM705 & AEM804
PHE- storages, processes with farmer added value i.e. cost effective refrigeration systems etc	Added in AEM705 & AEM804
Visits to IARI and ICAR facilities	Added in AEM609
Geomatics – land correction or land plot boundary correction	Added in AEM612
Horticulture and crop protection –2 separate subjects	incorporated in AEM401
IOT include inside side (exp: water mgmt.) and output side (exp: ripening of crops) IOT system	Added in AEM511
Agri Extension should be more comprehensive – 3 credits	Changed
Exposure to agritech startups – projects to students about listing the startups their studies, case studies	Added in AEM705 & AEM804

Minutes of meeting - BOS

- Prof. J. P. Gupta Appreciated the selection and structure of elective courses incorporated in the curriculum, which consider the recommendations of ICAR and AICTE

Suggestions	Response
The syllabus should include:	
Prof. J. P. Gupta	
To incorporate the concepts of rural engineering	included in the course number AEM601 which is compulsory
To include a practical course on Field operation and maintenance of tractor and agricultural machinery	Included in RDC181, RDC281, AEW401, AEM502AEM504 and AEM 609
Prof. T. K. Bhattacharya	
To incorporate basic courses on principles of soil science, agronomy in 1 st or 2 nd semester	Since common courses are given in the first year for the lateral movement of students among the branches of Engineering, AEM301 is given in third semester and concepts of soil science are included in RDC281
To change the course name of “Geomatics” to “Surveying”	Civil Engineering department is offering the surveying course with title Geomatics
To include courses on manufacturing process II	Manufacturing processes I is advanced course covering concepts of Manufacturing II also

Minutes of meeting – BOS (cont...)

Suggestions	Response
The syllabus should include:	
Prof. T. K. Bhattacharya	
To change the course title from “Applied chemistry” to “Engineering chemistry”.	Suggestion may be forwarded to the appropriate academic authority
To incorporate field operations and maintenance of tractor in experiential learning course	Approved and included
To bring the elective course “Photovoltaic technology and systems” to mainstream agriculture engineering	This course is opened to all
To provide MEM703 (Refrigeration and air conditioning) and MEM704 (Thermal engineering lab-II) to 6 th semester as these subjects are important to dairy engineering specialization	This course is offered by Mechanical Engineering department and a request in this regard is forwarded
to add AEM806 Food plant design and management as common subject to all specializations	Approved and included
To establish three field laboratories-Farm power and machinery, Dairy and Food Engineering and Irrigation equipment lab to conduct experiential learning courses	Approved and included
to make actions to procure financial assistance from ICAR for infrastructure development for establishing	The possibilities of financial assistance will be explored

Minutes of meeting – BOS (cont...)

Suggestions	Response
The syllabus should include:	
Prof. T. K. Bhattacharya	
To add table depicting credits covered under different disciplines of agriculture engineering	Approved and included
To give tutorials along with theory as and where required	Approved and included.
Suggested minor change in the introduction to course curriculum.	Approved and included.

INTRODUCTION TO COURSE CURRICULUM

➤ The students are given an option to choose the area of specialization in any of the following stream from fifth semester onwards:

- Mainstream Agricultural Engineering
- Dairy Engineering Specialization
- Agritech and Entrepreneurship Specialization

Note: First year (I & II sem) is common to all branches of Engineering.

COURSE CURRICULUM-STRUCTURE

THIRD SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM301	PRINCIPLES OF AGRONOMY	2.0	Y	T
AEM302	AGRONOMYLAB	1.0	Y	P
AEM303	SOIL MECHANICS	3.0	Y	T
AEM304	SOIL TECH LAB	1.0	Y	P
EEM301	BASIC ELECTRONICS	3.0	Y	T
EEM302	BASIC ELECTRONICS LAB	1.0	Y	P
EEM303	DATA STRUCTURE	3.0	Y	T
MEM307	MECHANICS OF SOLIDS AND FLUIDS	3.0	Y	T
MEM308	MATERIAL TESTING AND FLUIDS LAB	1.0	Y	P
MAM381	ENGINEERING MATHEMATICS III	3.0	Y	T
ENH381	ENGLISH III	3.0	Y	T
EGC381	PRODUCT MANUFACTURING PROJECT	1.0	Y	P
EGC382	PRACTICAL TRAINING	2.0	Y	P
GKC381	SC. METH., GK,& CURRENT AFFAIRS III	1.0	N	T
Total Credits		28.0		

FOURTH SEMESTER

COURSE NUM.	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM401	HORTICULTURE CROP MANAGEMENT	2.0	Y	T
AEM402	ENGINEERING PROPERTIES OF AGRICULTURAL PRODUCE	2.0	Y	T
AEM403	IRRIGATION ENGINEERING	3.0	Y	T
AEM404	IRRIGATION ENGINEERING LAB	1.0	Y	P
CEM404	GEOMATICS I	3.0	Y	T
CEM405	GEOMATICS LAB	1.0	Y	P
MEM404	MECHANICS OF MACHINES	3.0	Y	T
MEM405	MECHANICS OF MACHINES LAB	1.0	Y	P
MEM410	HEAT AND MASS TRANSFER	2.0	Y	T
ENH481	ENGLISH IV	3.0	Y	T
EGC481	INDUSTRIAL VISIT	1.0	N	P
GKC481	SC.METH., G.K. & CURRENT AFFAIRS IV	1.0	N	T
CAC481	CO-CURRICULAR ACTIVITIES	3.0	N	P
WORK EXPERIENCE COURSE (Any one from the following)				
AEW401	REPAIR OF FARM EQUIPMENT	2.0	N	P
AEW402	ENERGY AUDITING FOR POLYHOUSE & FARM STRUCTURES	2.0	N	P
DPW 401	COMMERCIAL ART	2.0	N	P
EEW402	REPAIR OF ELECTRICAL EQUIPMENT	2.0	N	P
EEW403	3D PRINTING TECHNIQUES	2.0	N	P
EEW404	MICRO CONTROLLERS & IOT	2.0	N	P
MEW402	PHOTOGRAPHY	2.0	N	P
MEW403	REFRIGERATION & AIRCONDITIONING	2.0	N	P
TOTAL CREDITS		28.0		

FIFTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM501	FARM MACHINERY AND EQUIPMENT I	3.0	Y	T
AEM502	FARM MACHINERY AND EQUIPMENT I LAB	1.0	Y	P
AEM503	TRACTOR AND AUTOMOBILE ENGINES	3.0	Y	T
AEM504	STATIONARY AND AUTOMOTIVE ENGINES LAB	1.0	Y	P
AEM505	SOIL AND WATER CONSERVATION ENGINEERING	2.0	Y	T
AEM506	AGROECOLOGY AND FOOD SUSTAINABILITY	2.0	Y	T
EEM507	ELECTRICAL TECHNOLOGY	3.0	Y	T
EEM508	ELECTRICAL TECHNOLOGY LAB	1.0	Y	P
EGC581	DESIGN ENGG./ THEME DEVELOP. PROJECT	1.0	N	P
EGC582	PRACTICAL TRAINING	2.0	N	P
CRC581	COMPARATIVE STUDY OF RELIGIONS	2.0	N	T
MAINSTREAM AGRICULTURAL ENGINEERING				
AEM507	CROP PROCESS ENGINEERING	3.0	Y	T
AEM508	PHE LAB	1.0	Y	P
MAM582	PROBABILITY AND STATISTICS	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM509	INTRODUCTION TO DAIRY FARMING	3.0	Y	T
AEM510	DAIRY FARMING LAB	1.0	Y	P
MAM582	PROBABILITY AND STATISTICS	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM511	IOT IN AGRICULTURE SYSTEMS	3.0	Y	T
AEM512	IOT LAB	1.0	Y	P
MAM582	PROBABILITY AND STATISTICS	3.0	Y	T
TOTAL CREDITS		28.0		

SIXTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
MEM614	MACHINE DESIGN	3.0	Y	T
MEM615	DESIGN PRACTICE AND CAD APPLICATIONS	2.0	Y	P
AEM601	AGRICULTURAL STRUCTURES AND ENVIRONMENT CONTROL	3.0	Y	T
AEM602	WATERSHED HYDROLOGY, PLANNING AND MANAGEMENT	3.0	Y	T
AEM603	REMOTE SENSING AND GIS	2.0	Y	T
AEM604	SOIL AND WATER LAB	1.0	Y	P
AEM605	FARM MACHINERY AND EQUIPMENT II	2.0	Y	T
AEM606	FARM MACHINERY AND EQUIPMENT II LAB	1.0	Y	P
AEM607	RENEWABLE POWER SOURCES	2.0	Y	T
EGC681	DESIGN ENGG./THEME DEVELOP. PROJECT	1.0	Y	P
CEC681	CULTURAL EDUCATION	2.0	N	T
CAC681	CO-CURRICULAR ACTIVITIES	3.0	N	P
MAINSTREAM AGRICULTURAL ENGINEERING				
AEM608	DRAINAGE ENGINEERING	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
DAIRY ENGINEERING SPECIALIZATION				
AEM611	RHEOLOGY OF DAIRY PRODUCTS	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM612	INFORMATION TECHNOLOGY FOR LAND AND WATER MANAGEMENT	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
TOTAL CREDITS		29.0		

SEVENTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM701	AGRICULTURAL ENGINEERING PROJECT I	3.0	N	P
AEM702	SEMINARS	1.0	N	P
AEM703	FARM BUSINESS MANAGEMENT AND VILLAGE INDUSTRIES	3.0	Y	T
AEM704	PROFESSIONAL ETHICS AND CONCIOUSNESS	2.0	Y	T
AEM705	MINOR PROJECT-I	1.0	N	P
MEM703	REFRIGERATION AND AIR CONDITIONING	3.0	Y	T
MEM704	THERMAL ENGINEERING LAB II	1.0	Y	P
EGC781	CO-OP TRAINING AND EXPERIENTIAL LEARNING	4.0	Y	P
#	STREAM WISE CORE COURSES	7.0	Y	T
*	STREAM WISE OPTIONAL COURSES	3.0	Y	T
TOTAL CREDITS		28.0		

SEVENTH SEMESTER (cont...)

Stream-wise CORE Courses (#):

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM706	WATER HARVESTING AND SOIL CONSERVATION STRUCTURES	3.0	Y	T
AEM707	GROUND WATER WELL AND PUMPS	3.0	Y	T
AEM708	HYDROLOGY LAB	1.0	Y	P
DAIRY ENGINEERING SPECIALIZATION				
AEM709	FOOD QUALITY AND CONTROL	3.0	Y	T
AEM710	DAIRY ENGINEERING	3.0	Y	T
AEM711	DAIRY ENGINEERING LAB	1.0	Y	P
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM712	AGRICULTURE MARKETING TRADE & PRICES	3.0	Y	T
AEM713	AI AND MACHINE LEARNING IN AGRICULTURE	3.0	Y	T
AEM714	MODERN AGRITECH LAB	1.0	Y	P

SEVENTH SEMESTER (cont...)

Stream-wise OPTIONAL Courses any one of the following (*):

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM715	BIO ENERGY SYSTEMS	3.0	Y	T
AEM716	SEED PROCESSING TECHNOLOGY	3.0	Y	T
AEM717	DESIGN OF STRUCTURES	3.0	Y	T
AEM718	AGRICULTURE DATA ANALYTICS	3.0	Y	T
AEM719	FARM MACHINERY DESIGN AND PRODUCTION	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P
DAIRY ENGINEERING SPECIALIZATION				
AEM721	NUTRITIONAL MANAGEMENT IN DAIRY FARM	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM718	AGRICULTURE DATA ANALYTICS	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
AEM722	UAV IN AGRICULTURE	3.0	Y	T
AEM723	SENSORS AND MICRO CONTROLLERS	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P

EIGHTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM801	AGRICULTURAL ENGINEERING PROJECT II	8.0	Y	P
AEM802	AGRICULTURE EXTENSION	3.0	N	T
AEM803	AGRICULTURE EXTENSION PRACTICE	1.0	Y	P
AEM804	MINOR PROJECT-II	1.0	Y	P
CAC881	CO-CURRICULAR ACTIVITIES	3.0	N	P
#	STREAM WISE CORE COURSES	3.0	Y	T
*	STREAM WISE FIRST OPTIONAL COURSES	3.0	Y	T
**	STREAM WISE SECOND OPTIONAL COURSES	3.0	Y	T
***	STREAM WISE THIRD OPTIONAL COURSES	3.0	Y	T
TOTAL CREDITS		28.0		

Stream-wise CORE Courses (#):

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM805	TRACTOR SYSTEMS AND CONTROLS	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM806	FOOD PLANT DESIGN AND MANAGEMENT	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM807	CONSUMER BEHAVIOUR & ANALYSIS	3.0	Y	T

EIGHTH SEMESTER (cont...)

STREAM-WISE FIRST OPTIONAL COURSES (*) - any one of the following to be opted

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM808	PRECISION FARMING TECHNIQUES FOR FIELD AND PROTECTED CROP PRODUCTION	3.0	Y	T
AEM809	POSTHARVEST ENGINEERING OF HORTICULTURE CROPS	3.0	Y	T
AEM810	PLASTIC APPLICATION IN AGRICULTURE	3.0	Y	T
AEM811	MECHATRONICS	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM812	DEVELOPMENT OF PROCESSED PRODUCTS	3.0	Y	T
AEM810	PLASTIC APPLICATION IN AGRICULTURE	3.0	Y	T
AEM811	MECHATRONICS	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM813	INTELLETUAL PROPERTY RIGHT	3.0	Y	T
AEM814	PREDICTIVE ANALYTICS IN AGRICULTURE	3.0	Y	T

EIGHTH SEMESTER (cont...)

STREAM-WISE SECOND OPTIONAL COURSES () - any one of the following to be opted**

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM815	WASTELAND DEVELOPMENT	3.0	Y	T
AEM816	HYDRAULIC DRIVES AND CONTROLS	3.0	Y	T
AEM817	WASTE AND BYPRODUCT UTILIZATION	3.0	Y	T
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
AEM819	SPRINKLER AND MICRO IRRIGATION SYSTEM	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM820	PROCESS EQUIPMENT DESIGN	3.0	Y	T
AEM821	PACKAGING TECHNOLOGY	3.0	Y	T
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
MEM824	TOTAL QUALITY MANAGEMENT	3.0	Y	T

EIGHTH SEMESTER (cont...)

STREAM-WISE THIRD OPTIONAL COURSES (*) - any one of the following to be opted**

AEM822	PRECISION AGRICULTURE AND SYSTEM MANAGEMENT	3.0	Y	T
AEM823	PHOTOVOLTAIC TECHNOLOGY AND SYSTEMS	3.0	Y	T
EEM811	ROBOTICS	3.0	Y	T
MEM809	NANO-TECHNOLOGY & NANO-COMPUTING	3.0	Y	T
MEM811	FUTURES STUDIES	3.0	Y	T
MEM814	MANAGEMENT INFORMATION SYSTEMS	3.0	Y	T
MEM827	OPERATIONS MANAGEMENT	3.0	Y	T

DETAILED SYLLABUS

THIRD SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM301	PRINCIPLES OF AGRONOMY	2.0	Y	T
AEM302	AGRONOMYLAB	1.0	Y	P
AEM303	SOIL MECHANICS	3.0	Y	T
AEM304	SOIL TECH LAB	1.0	Y	P
EEM301	BASIC ELECTRONICS	3.0	Y	T
EEM302	BASIC ELECTRONICS LAB	1.0	Y	P
EEM303	DATA STRUCTURE	3.0	Y	T
MEM307	MECHANICS OF SOLIDS AND FLUIDS	3.0	Y	T
MEM308	MATERIAL TESTING AND FLUIDS LAB	1.0	Y	P
MAM381	ENGINEERING MATHEMATICS III	3.0	Y	T
ENH381	ENGLISH III	3.0	Y	T
EGC381	PRODUCT MANUFACTURING PROJECT	1.0	Y	P
EGC382	PRACTICAL TRAINING	2.0	Y	P
GKC381	SC. METH., GK,& CURRENT AFFAIRS III	1.0	N	T
Total Credits		28.0		

AEM301-PRINCIPLES OF AGRONOMY (2.0)

Class: B.Tech., Status of Course: FULL COURSE, Approved since session:
Total Credits:2, Periods(55 mts. Each)/week:2(L-2+T/P/S-0), Min.pds./sem.:26

- **Unit 1:**

Agronomy and its scope, seeds and sowing, tillage and tith, crop density and geometry.

- **Unit 2:**

Crop nutrition, manures and fertilizers, nutrient use efficiency.

- **Unit 3:**

Water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, water logging.

- **Unit 4:**

Weeds- importance, classification, crop weed competition, concepts of weed management- principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

- **Unit 5:**

Growth and development of crops, factors affecting growth and development, plant ideotypes, cropping systems, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

References/Suggested Reading:

- De, Gopal Chandra 1989, Fundamentals of Agronomy. Oxford & IBH Publishing Co., New-Delhi.
- ICAR 1989 Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi
- Michael, A.M. and Ojha, T.P. 1986. Principles of Agricultural Engineering, Vol.II Jain Brothers, New Delhi.
- Morachan, Y.B. 1986, Crop production and management, Oxford & IBH Publishing Co., New-Delhi.

AEM302-AGRONOMY LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Identification of crops and their varieties;
2. Identification of seeds;
3. Identification of manures;
4. Identification of fertilizers;
5. Identification of weeds;
6. Fertilizer application methods;
7. Different weed control methods;
8. Practice of ploughing, Practice of Puddling,
9. Practice of sowing
10. Judging maturity time for harvesting of crop;
11. Study of seed viability and germination test;
12. seed extraction techniques; identification of important pests and diseases and their control.
13. Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement,
14. Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill,
15. Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water.

AEM303-SOIL MECHANICS (3.0)

Class: B.Tech., Status of Course: FULL COURSE, Approved since session:

Total Credits:3, Periods(55 mts. Each)/week:3(L-3+T-1+P/S-0), Min.pds./sem.:52

■ **Unit 1**

Soil genesis and classification - Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, classification of soils – soil taxonomy orders, Important soil physical properties; and their importance; soil particle distribution. Soil colloids– their composition, properties and origin of charge;

■ **Unit 2**

Ion exchange in soil and nutrient availability, Soil organic matter – its composition and decomposition, effect on soil fertility, Soil reaction – acidic, saline and sodic soils; quality or irrigation water; essential plants nutrients – their functions and deficiency symptoms in plants; important inorganic fertilizers and their reactions in soils, Use of saline and sodic water for crop production, Gypsum requirement for reclamation of sodic soils and neutralising RSC; Liquid fertilizers and their solubility and compatibility.

■ **Unit 3**

Introduction of soil mechanics, field of soil mechanics, phase diagram, physical and index properties of soil, classification of soils, effective and neutral stress, elementary concept of Boussinesq and Westergaard's analysis, new mark influence chart. Seepage Analysis; Quick condition-two dimensional flow-Laplace equation, Velocity potential and stream function, Flow net construction.

■ **Unit 4**

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 test, triangle test & vane shear test. Compaction, composition of soils standard and modified protector test.

AEM303-SOIL MECHANICS (3.0) (cont...)

▪ **Unit 5**

Abbot compaction and Jodhpur mini compaction test field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method, determination of coefficient of consolidation. Earth pressure, Rankine's theory of earth pressure, Stability of slopes, Taylor's stability number.

Suggested Readings

- Brady Nyle C and Ray R Well. 2002. Nature and properties of soils. Pearson Education Inc., New Delhi.
- Indian Society of Soil Science. 1998. Fundamentals of Soil Science. IARI, New Delhi
- Biswas TD. And Mukherjee, S.K. "Text Book of Soil Science" "New Delhi, Tata Mgraw, 1987.
- Ghildyal B.P. and Tripathi, R.P. "Soil Physics", Wiley eastern Ltd, 1987.
- Hillel, D. "Introduction to Soil Physics" , San Diego, Academic press, 1982.

AEM304-SOIL TECH LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Identification of rocks and minerals; Examination of soil profile in the field;
2. Collection of Soil Sample; Determination of bulk density; particle density and porosity of soil;
3. Determination of organic carbon of soil; Determination of Nitrogen, Determination of Phosphorus and Determination of Potassium;
4. Identification of nutrient deficiency symptoms of crops in the field; Determination of gypsum requirement of sodic soils;
5. Determination of water quality parameters. Determination of water content of soil/determination of specific gravity of soil;
6. Determination of field density of soil by core cutter method; Determination of field density by sand replacement method;
7. Grain size analysis by sieving (Dry sieve analysis); Grain size analysis by hydrometer method;
8. Determination of liquid limit by Casagrande's method; Determination of liquid limit by cone penetrometer and plastic limit; Determination of shrinkage limit;
9. Determination of permeability by constant head method; Determination of permeability by variable head method;
10. Determination of compaction properties by standard proctor test; Determination of shear parameters by Direct shear test;
11. Determination of unconfined compressive strength of soil;
12. Determination of shear parameters by Tri-axial test;
13. Determination of consolidation properties of soils.

EEM301-BASIC ELECTRONICS (3.0)

Class: B.Tech., Status of Course: FULL COURSE, Approved since session: 2015-16

Total Credits:3, Periods(55 mts. Each)/week:3(L-3+T-1+P/S-0), Min.pds./sem.:39

• UNIT 1

Intrinsic & Extrinsic Semiconductors. P-N Junction Diode, Working Principle, Forward and Reverse Characteristics, Breakdown, DC and AC Load Lines, Dynamic Resistance. Specifications, Rectifier Configurations, Filtering, Regulation, Zener Diode, Voltage Regulators.

• UNIT 2

Qualitative description of charge transport in BJT, α , β , CE, CD, and CC configurations, Input & output characteristics. Biasing schemes. DC and AC load lines, Maximum Symmetrical Swing, Bias Stability Power Calculations.

• UNIT 3

Amplifier as a two port. Classification as VCVS, VCCS, CCVS and CCCS. Gain and its logarithmic units. Concept of feedback in amplifiers. Ideal Op-amp, applications, e.g., inverting, non-inverting, summing and differentiating amplifiers, differentiation integrator, comparator, Schmitt trigger, logarithmic amplifier.

• UNIT 4

Number systems and Codes, BCD, ASCII, Excess 3 and Gray codes. Code conversion. Negative number representation. Binary addition and subtraction. Boolean algebra & truth tables and basic logic gates, universal gates, half adder, full adder circuits.

• UNIT 5

Flip-flops as memory elements, registers, counters (only working principles no design problem), Memories. Need for Digital to Analog/Analog to Digital conversion, Digital to Analog conversion techniques, Analog to Digital conversion schemes.

SUGGESTED READING:

- Malvino & Leach: DIGITAL COMPUTER ELECTRONICS
- V Del Toro: ELECTRICAL ENGINEERING FUNDAMENTALS
- Millaman & Grabel: MICROELECTRONICS
- HUGHES ELECTRICAL AND ELECTRONIC TECHNOLOGY revised by I McKenzie Smith

EEM301-BASIC ELECTRONICS (3.0) (cont...)

• UNIT 5

Flip-flops as memory elements, registers, counters (only working principles no design problem), Memories. Need for Digital to Analog/Analog to Digital conversion, Digital to Analog conversion techniques, Analog to Digital conversion schemes.

SUGGESTED READING:

- Malvino & Leach: DIGITAL COMPUTER ELECTRONICS
- V Del Toro: ELECTRICAL ENGINEERING FUNDAMENTALS
- Millaman & Grabel: MICROELECTRONICS
- HUGHES ELECTRICAL AND ELECTRONIC TECHNOLOGY revised by I McKenzie Smith

EEM302-BASIC ELECTRONICS LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2015-16

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Network Theorem verification
2. RLC circuit Response
3. p-n junction characteristics
4. BJT characteristics
5. Biasing circuit analysis and design.
6. Frequency response of CE amplifier.
7. Op-amp and inverting/non-inverting amplifier.
8. Astable multivibrator using IC555 timer.
9. Monostable multivibrator using IC555 timer

EEM303-DATA STRUCTURE (3.0)

Class: B.Tech., Status of Course: FULL COURSE, Approved since session: 2015-16

Total Credits:3, Periods(55 mts. Each)/week:3(L-3+T-1+P/S-0), Min.pds./sem.:39

- **UNIT 1**

Structures and Files, Algorithms and Introduction to Complexity Analysis, Program Development with step-wise refinement.

- **UNIT 2**

Arrays, Stacks, Queues and Strings.

- **UNIT 3**

Pointers, Linked Lists, Creation, Insertion and other data processing applications.

- **UNIT 4**

Trees, Graphs.

- **UNIT 5**

Searching and sorting Algorithms and their analysis.

SUGGESTED READINGS:

- AS Tannenbaum, Y Langsam, M. Augenstein: DATA STRUCTURES USING C AND C++, 2nd Edition, Prentice Hall.
- Mark A Weiss: DATA STRUCTURES AND PROBLEM SOLVING USING C++, 2nd Edition, Addison Wesley.
- R Kruse, B. Leung, C Tondo: DATA STRUCTURES AND PROGRAM DESIGN IN C, Prentice Hall.

MEM307-MECHANICS OF SOLIDS AND FLUIDS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2000-01

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem.: 39

- **UNIT 1**

UNIAXIAL STRESS & STRAIN: Stress in axially loaded members, strain, constitutive laws. Axial deformation.

STRESS TRANSFORMATION: Two-dimensional stress system. Analytical and Mohr's circle methods. Principal stresses & planes maximum shear stress.

- **UNIT 2**

TORSION: Torsion of circular bars. Torsion formula. Shear stress. Angle of twist.

BENDING: Flexure formula. Bending stress. Shear stress in beams.

- **UNIT 3**

COLUMN: Elastic buckling. Euler's formula. Various end conditions. Rankine formula. Empirical formulas.

FLUID MECHANICS: Lagrangian and Eulerian approaches. Lines of flow. Path line. Streamline. Streak line. Stream tube. Types of flow. Steady and unsteady, uniform and non-uniform, laminar & turbulent. Continuity equation (one dimensional).

TYPES OF ENERGIES: Potential, Kinetic, and Pressure Energies. Bernoulli's theorem. Its proof and limitations. K.E. correction factor.

- **UNIT 4**

FLOW MEASUREMENT: Principles. Venturimeter, horizontal, vertical & inclined. Orifices, classification, vena contracta. Hydraulic coefficients. Discharge through a large rectangular orifice. Drowned and partially drowned orifices.

MOUTH PIECES: Types. External mouthpiece. Convergent divergent mouthpiece. Notches. Types. Rectangular and triangular notches. Weirs. Types. Rectangular weir. Francis and basins formulae. Velocity of approach.

MEM307-MECHANICS OF SOLIDS AND FLUIDS (3.0)

(cont...)

- **UNIT 5**

FLOW THROUGH PIPES: Reynold's experiment. Types of flow. Critical velocities. Reynold's number. Friction loss. Darcy-Weisbach equation. Friction factor concept. Losses at entry, exit, bend and valves. Hydraulic and energy gradient lines. Power transmission through pipes. Condition for maximum power.

FLOW THROUGH OPEN CHANNELS: Chezy's & Manning's equations. Bazin's and Kutter's expressions for Chezy's constants. Best discharging section. Rectangular & Trapezoidal channels.

SUGGESTED READINGS:

- Popov: ENGINEERING MECHANICS OF SOLIDS Jain: FLUID MECHANICS
- Singer: STRENGTH OF MATERIALS Jagdish Lal: HYDRAULIC AND FLUID MECHANICS
- Junarkar: MECHANICS OF STRUCTURES Punmia & Goyal: STRENGTH OF MATERIAL

MEM308-MATERIAL TESTING AND FLUIDS LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2000-2001

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Determination of Tensile strength of a mild steel specimen
2. Determination of hardness of a material on hardness tester.
3. Determination of impact strength/ toughness on Izod Test machine.
4. Determination of angle of twist and torque value on torsion test machine.
5. Determination of compressive stress for a brick on UTM
6. Determination of coefficient of discharge using Venturimeter for a pipe flow.
7. Determination of coefficient of discharge using mouth piece and orifice and to find out discharge.
8. Experiment on 60 degree and 90 degree V notch for a channel flow.
9. Determine the value of coefficient of friction, 'f' for the given G.I. pipe
10. Obtain the value of coefficient of discharge at six different heads for $\frac{3}{4}$ " cylindrical mouthpiece (a) discuss the variation of actual C with head (b) discuss the variation of actual C with H

MAM381-ENGINEERING MATHEMATICS III (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2009-10

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem.: 39

- **UNIT 1**

Standard Forms, Shifting and Convolution Theorems, Transforms of derivatives. Inverse Laplace Transforms, Laplace transforms of error function, Heavyside Direct Delta Functions, Applications of Laplace Transforms.

- **UNIT 2**

Finite and Infinite Fourier Transforms, Fourier Integral Theorem, Inversion Theorem, Applications of Fourier Transforms.

- **UNIT 3**

Analytic Function, Cuachy-Reimann Equation, Conjugate harmonic functions.

- **UNIT 4**

Integration, Cauchy's Theorem, Cauchy's Integral Formulae, Taylor's and Lautent's expansions, Zeros and poles.

- **UNIT 5**

Residues, Cauchy Residues Theorem, Simple problems in contour integration.

SUGGESTED READINGS:

- MD Raisinghania: INTEGRAL TRANSFORMS
- Schaum's Series: LAPLACE TRANSFORM
- Schaum's Series: COMPLEX VARIABLES

ENH381-ENGLISH III (3.0)

Class: B.Tech., Status of Course: NF HALF COURSE, Approved since session: 2009-10

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 39

- **UNIT 1**

Reading and Listening Comprehension

- **UNIT 2**

Basics and Forms of Technical and Business Communication.

- **UNIT 3**

Precise and Paragraph writing

- **UNIT 4**

Writing of Scientific and Technical Texts

- **UNIT 5**

Essay writing and Expansion

EGC381-PRODUCT MANUFACTURING PROJECT (1.0)

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2007-08

Total Credits: 1.0, Periods (55 mts. each)/week: 2 (L:0+T:0+P:3+S:0), Min.pds./sem.: 39

For B.Tech. Agricultural Engineering

1. Design and installation of water harvesting structures at a smaller scale
2. Development of sensors for estimation of soil characteristics
3. Development of mobile applications for nutrient management, irrigation management, crop health monitoring etc.
4. Design and install hydroponic/aeroponic system for any vegetable crop
5. Development of farm machinery tools for small scale field operations
6. Proration and characterisation of soil less media from waste materials
7. Development of solar operated system for various farm operations
8. Design and implementation of safety measures for dairy farm
9. Manufacture of nutrient rich food products

EGC381-PRODUCT MANUFACTURING PROJECT (1.0) (cont...)

For B.Tech. Civil, Electrical, Mechanical Engineering and Footwear Technology

- **PRODUCT DESIGN:** Product development process tools, Product function, Bench marking and engineering specifications. (Evaluation on the above theory will constitute 20% of the total marks)

The students are encouraged to

- 1. Identify the products for the project.
- 2. To check the technical feasibility and financial viability of the project.
- 3. To discuss the above during brain solving session.
- 4. To prepare utility article as furniture jigs & fixtures. Science and Engineering models for demonstration purpose.

EGC382-PRACTICAL TRAINING (2.0)

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01

For B.Tech. Agricultural Engineering

Total Credits: 2

- The students are expected to undergo practical training in industries and local and in house farm engineering facilities to acquaint themselves with various shop floor activities, agri-techno, renewable and bio-engineering environment and problem faced in industries and various farm engineering ventures and enterprises. They are required to submit a report on the training and be evaluated through internal and external viva voce.

For B.Tech. Civil, Electrical, Mechanical Engineering and Footwear Technology

- The students are expected to undergo practical training in different industries allotted to them at different places, in order to acquaint themselves with the various shop floor activities, industrial environment, problems faced in industries. They are required to submit a report on the training and the evaluation through internal and external viva voce.

GKC381-SC.METH., GK,&CURRENT AFFAIRS III (1.0)

Class: B.Tech., Status: Core Course, Approved since session: 2014-15

Total Credits: 1, Periods(55 mts. each)/week:1(L-1+ T-0 +P/S-0), Min.pds./sem. :26

- **UNIT 1: SCIENCE** - Some basic definitions of Scientific terms.
- **UNIT 2: SCIENCE** - Human Physiology and anatomy, Hygiene, Drugs, Diseases, Health Organizations.
- **UNIT 3: SCIENCE** - Information Technology - basic terminology, development in India, Biotechnology - basic terminology, important centres in India and World.
- **UNIT 4: SCIENCE** - Inventions and discoveries, Indian Space Programmes, Atomic energy in India, Research centres and Laboratories in India.
- **UNIT 5: ENVIRONMENTAL STUDIES-POLLUTION AND DISASTER MANAGEMENT**
Definition, Causes, Effects and Control Measures of Air, Water, Soil, Marine, Noise and Thermal Pollution, Radiation Pollution, Nuclear Hazards, Solid Waste Management, Role of an Individual in Prevention of Pollution. Floods, Earthquake, Cyclone and Land Slides.

FOURTH SEMESTER

COURSE NUM.	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM401	HORTICULTURE CROP MANAGEMENT	2.0	Y	T
AEM402	ENGINEERING PROPERTIES OF AGRICULTURAL PRODUCE	2.0	Y	T
AEM403	IRRIGATION ENGINEERING	3.0	Y	T
AEM404	IRRIGATION ENGINEERING LAB	1.0	Y	P
CEM404	GEOMATICS I	3.0	Y	T
CEM405	GEOMATICS LAB	1.0	Y	P
MEM404	MECHANICS OF MACHINES	3.0	Y	T
MEM405	MECHANICS OF MACHINES LAB	1.0	Y	P
MEM410	HEAT AND MASS TRANSFER	2.0	Y	T
ENH481	ENGLISH IV	3.0	Y	T
EGC481	INDUSTRIAL VISIT	1.0	N	P
GKC481	SC.METH., G.K. & CURRENT AFFAIRS IV	1.0	N	T
CAC481	CO-CURRICULAR ACTIVITIES	3.0	N	P
WORK EXPERIENCE COURSE (Any one from the following)				
AEW401	REPAIR OF FARM EQUIPMENT	2.0	N	P
AEW402	ENERGY AUDITING FOR POLYHOUSE & FARM STRUCTURES	2.0	N	P
DPW 401	COMMERCIAL ART	2.0	N	P
EEW402	REPAIR OF ELECTRICAL EQUIPMENT	2.0	N	P
EEW403	3D PRINTING TECHNIQUES	2.0	N	P
EEW404	MICRO CONTROLLERS & IOT	2.0	N	P
MEW402	PHOTOGRAPHY	2.0	N	P
MEW403	REFRIGERATION & AIRCONDITIONING	2.0	N	P
TOTAL CREDITS		28.0		

AEM401-HORTICULTURE CROP MANAGEMENT (2.0)

Class: B.Tech., Status of Course: FULL COURSE, Approved since session:

Total Credits:2, Periods(55 mts. Each)/week:2(L-2+T-0+P/S-0), Min.pds./sem.:26

• **Unit 1**

Scope of horticultural. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, Judging maturity time for harvesting of crop; Study of seed viability and germination test;

• **Unit 2**

Criteria for site selection, layout and planting methods, nursery raising, commercial varieties/hybrids, sowing and planting times and methods, seed rate and seed treatment for vegetable crops; Identification and description of important fruits, flowers and vegetable crops;

• **Unit 3**

Macro and micro propagation methods, plant growing structures, pruning and training, crop coefficients, water requirements and critical stages, Preparation of nursery bed; Practices of pruning and training in some important fruit crops

• **Unit 4**

Fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post-harvest practices, Garden tools, Study of different garden tools; cultural operations for vegetable crops (sowing, fertilizer application, mulching, irrigation and weed control)

• **Unit 5**

Management of orchard, Extraction and storage of vegetables seeds. Major pests and diseases and their management in horticulture crops. seed extraction techniques; identification of important pests and diseases and their control, visit to commercial greenhouse/ polyhouse

Suggested Readings

- Bansal. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.
- Saraswathy, S., T.L.Preethi, S.Balasubramanyan, J. Suresh, N.Revathy and S.Natarajan. 2007.
- Postharvest management of Horticultural Crops. Agrobios Publishers, Jodhpur.
- Arjunan, G., Karthikeyan, G, Dinakaran , D. and Raguchander, T. 1999. Diseases of Horticultural Crops. AE Publications, Coimbatore.
- Sharma Neeta and Mashkoo Alam. 1997. Postharvest diseases of Horticultural crops. International Book publishing Co. UP.

AEM402-ENGINEERING PROPERTIES OF AGRICULTURAL PRODUCE (2.0)

Class: B.Tech., Status of Course: FULL COURSE, Approved since session:

Total Credits:2, Periods(55 mts. each)/week:3(L-2+T-1+P/S-0), Min.pds./sem.:3

• **Unit 1**

Classification and importance of engineering properties of Agricultural Produce, shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area of grains, fruits and vegetables, Thermal properties, Heat capacity, Specific heat, Thermal conductivity, Thermal diffusivity, Heat of respiration;

• **Unit 2**

Co-efficient of thermal expansion, Friction in agricultural materials; Static friction, Kinetic friction, rolling resistance, angle of internal friction, angle of repose, Flow of bulk granular materials, Aero dynamics of agricultural products, drag coefficients, terminal velocity.

• **Unit 3**

Rheological properties; force, deformation, stress, strain, elastic, plastic and viscous behaviour, Newtonian and Non-Newtonian liquid, Visco-elasticity, Newtonian and Non-Newtonian fluid, Pseudo-plastic,

• **Unit 4**

Dilatant, Thixotropic, Rheopectic and Bingham Plastic Foods, Flow curves. Electrical properties; dielectric loss factor, loss tangent, A.C. conductivity and dielectric constant, method of determination.

• **Unit 5**

Application of engineering properties in handling processing machines and storage structures

Suggested Readings

- Mohesin, N.N. 1980. Physical Properties of Plants & Animals. Gordon & Breach Science Publishers , New York.
- Mohesin, N.N. 1980. Thermal Properties of Foods and Agricultural Materials. Gordon & Breach Science Publishers , New York.
- Prentice, J.H. 1984. Measurement in Rheological Properties of Food Stuffs. Elsevier Applied science Pub. Co. Inc. New York.
- Rao, M.A. and Rizvi, S.H., 1995. Engineering Properties of Foods. Marcel Dekker Inc. New York.
- Singhal OP & Samuel DVK. 2003. Engineering Properties of Biological Materials. Saroj Prakashan.

AEM403-Irrigation Engineering (3.0)

Class: B.Tech., Status of Course: FULL COURSE, Approved since session:

Total Credits:3, Periods(55 mts. each)/week:3(L-3+T-1+P/S-0), Min.pds./sem.:52

• **Unit 1**

Major and medium irrigation schemes of India, purpose of irrigation, environmental impact of irrigation projects, source of irrigation water, present status of development and utilization of different water resources of the country

• **Unit 2**

Measurement of irrigation water: weir, flumes and orifices and other methods; open channel water conveyance system : design and lining of irrigation field channels, on farm structures for water conveyance, control & distribution;

• **Unit 3**

Underground pipe conveyance system: components and design; land grading: criteria for land levelling, land levelling design methods, estimation of earth work;

• **Unit 4**

Soil water plant relationship: soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants, measurement of soil moisture, moisture stress and plant response;

• **Unit 5**

Water requirement of crops: concept of evapotranspiration (ET), measurement and estimation of ET, water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface methods of water application: border, check basin and furrow irrigation-adaptability, specification and design considerations.

Suggested Readings

- Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing House New Delhi.
- Majumdar D. K. 2013. Irrigation Water Management Principles. PHI learning Private Limited New Delhi 2nd Edition.
- Allen R. G., L. S. Pereira, D. Raes, M. Smith. 1998. Crop Evapotranspiration – Guidelines for computing crop water requirement. Irrigation and drainage Paper 56, FAO of United Nations, Rome.

AEM404-Irrigation Engineering Lab (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Measurement of soil moisture by different soil moisture measuring instruments;
2. measurement of irrigation water;
3. measurement of infiltration characteristics;
4. determination of bulk density, field capacity and wilting point;
5. estimation of evapotranspiration;
6. land grading methods;
7. design of underground pipeline system;
8. estimation of irrigation efficiency;
9. study of advance, recession and computation of infiltration opportunity time;
10. infiltration by inflow-outflow method;
11. evaluation of border irrigation method;
12. evaluation of furrow irrigation method;
13. evaluation of check basin irrigation method.

CEM404-GEOMATICS I (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2015-16
Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem:52

- **UNIT 1**

Basic concepts of surveying: Objectives; Basic measurements, control networks, locating topographic details; Units of measurement; Error in measurement and their types, indices of precision, weight, outliers; Error sources, types; accuracy and precision, propagation of variance/covariance. Linear measurements: Taping; Optical distance measurement; Electronic distance measurement, classification and calibration; Errors in distance measurement and precautions. Vertical control: Level surface; Levelling principles, determination of height, leveling instruments; Sources of error and minimization, curvature and refraction effects; closure tolerances; Types of levelling; Characteristics of contours; methods of contouring

- **UNIT 2**

Concept of direction, azimuth, meridian; Theodolite, fundamental characteristic of theodolite and adjustment, measuring angles, sources of error Plane Tabling (PT): Accessories in PT, methods of PT, resection methods, preparation of map

- **UNIT 3**

Principle and basic system, subtense bar, various types of tachometers, plotting with tachometers Coordinate systems and datum transformation: Important surfaces in geodesy: earth surface, geoids, MSL, reference ellipsoid; Reference systems: 2D and 3D coordinate systems and transformations; map projection, UTM projection

CEM404-GEOMATICS I (3.0) (cont...)

• UNIT 4

Traversing: balancing of traverse, Triangulation, Trilateration, and Triangulation: Purpose, classification, strength of figure, well-conditioned triangle, triangulation figures, reconnaissance and station selection, inter-visibility of stations, signal and towers, base lining, computation and adjustment in triangulation, satellite station, Adjustments: Adjustment of errors using Least squares: observation equation and condition equation approach (preferably matrix-based solution)

• UNIT 5

Principles, classification, salient features of total station. GPS survey: Principles, errors, DGPS, DOP, GPS survey Methods and plans Construction surveys: Principle of setting out; Special instruments for setting out: Setting out a building, Setting out a highway curve

SUGGESTED READINGS:

- Arora, K. R., *Surveying*, Standard Book House, Delhi.
- Anderson, J.M. and Mikhail, E.M., *Surveying theory and practice*, 7th ed, McGraw-Hill 1997.
- Ghilani, C. D. and Wolf, P. R., *Elementary Surveying: An Introduction to Geomatics*, 13 ed, Prentice Hall, 2011.
- Schofield, W., *Engineering Surveying*, 6th ed, Butterworth Heinemann, Oxford.
- Sickle, J. V., *GPS for Land Surveyors*, 3rd ed. CRC Press, 2008.
- Agor, R. "Surveying", Vol. I & II Khanna Publications, Delhi.
- Arora, K.R., "Surveying" , Vol. I & II Standard Book House, Delhi,
- Bannister, A. and Baker, R., "Solving Problems in Surveying", Longman Scientific Technical, U.K., 1994.

CEM405-GEOMATICS I LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2015-16

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Visit to Lab. for the study of: a. Maps from Survey of India Publication b. Conventional Symbol Charts and Different types of maps.
2. To study instruments used in chain surveying and to measure distance between two points by ranging.
3. To determine the bearing of sides of a given traverse using Prismatic Compass, and plotting of the traverse.
4. To plot details using radiation and intersection methods in plane tabling.
5. To solve two point / three point problem in plane tabling.
6. To find out the reduced levels of given points using level. (Reduction by Height of Collimation method and Rise and Fall Method).
7. To determine and draw the longitudinal and cross-section profiles along a given route.
8. Practice for temporary adjustments of a Vernier Theodolite and taking Horizontal and Vertical angular measurements, by Reiteration method.
9. Measurement of horizontal angles by Repetition method.
10. Determination of the Tacheometric constants of a given theodolite.

MEM404-MECHANICS OF MACHINES (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2000-01

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 39

• **UNIT 1**

Links. Pairs. Chains. Mechanisms. Inversions. Graphical method of analysis for velocity and acceleration including Coriolis component of acceleration. Velocity and acceleration images. Instantaneous centre of velocity. Arnold Kennedy theorem of three centres. Special mechanisms such as straight line mechanisms, pantograph and Hooke's joint.

• **UNIT 2**

Number synthesis. Dimensional synthesis. Analytical and Graphical methods of dimensional synthesis.

DYNAMIC ANALYSIS: Reciprocating engine mechanism. Dynamically equivalent link. Its approximation and correction. Crank effort diagrams. Flywheel.

• **UNIT 3**

Velocity ratio and power transmitted by flat belt, V belt and rope. Slip. Creep. Centrifugal tension. Collars and pivots. Friction circle and friction axis. Clutches of different types.

• **UNIT 4**

Gravity controlled and spring controlled types. Centrifugal and inertia types. Controlling force. Sensitiveness. Stability. Isochronism. Hunting. Effort and power of a governor. **DYNAMOMETERS:** Absorption and transmission types.

• **UNIT 5**

Spur gears. Involute and cycloidal teeth. Path and arc of contact. Interference and undercutting in involute teeth. Gear trains, compound and epicyclic. Torque in epicyclic gear trains.

SUGGESTED READING:

- Ashok G Ambekar: MECHANISM AND MACHINE THEORY Ballaney: THEORY OF MACHINES
- Erdman & Sandor: MECHANISM DESIGN: ANALYSIS AND SYNTHESIS Thomas Bevan: THEORY OF MACHINES
- Shigley: THEORY OF MACHINES AND MECHANISMS Jagdish Lal: THEORY OF MECHANISMS AND MACHINES
- Ghosh & Mallik: THEORY OF MECHANISMS AND MACHINES

MEM405-MECHANICS OF MACHINES LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2000-01

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:1+S:1), Min.pds./sem: 26

1. Smooth inclined plane
2. Wheel & Differential axle
3. Worm & worm wheel
4. Friction in bearings
5. Flywheel
6. Screwjack.

MEM410-Heat and Mass Transfer (2.0)

Class: B.Tech., Status of Course: FULL COURSE, Approved since session:

- **Unit 1** Total Credits:2, Periods(55 mts. each)/week:2(L-2+T-1+P/S-0), Min.pds./sem.:26

Concept, 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 with and without heat generation.

- **Unit 2**

Electrical analogy. Insulation materials. Fins, Free and forced convection. Newton's law of cooling, heat transfer coefficient in convection.

- **Unit 3**

Dimensional analysis of free and forced convection. Useful non dimensional numbers. Equation of laminar boundary layer on flat plate and in a tube. Laminar forced convection on a flat plate and in a tube. Combined free and forced convection.

MEM410-Heat and Mass Transfer (2.0) (cont...)

- **Unit 4**

Introduction. Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. Heat transfer analysis involving conduction, convection and radiation by networks.

- **Unit 5**

Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow, Fick's law, mass transfer coefficients. Reynold's analogy.

Suggested Readings

- Geankoplis C.J. 1978. Transport Processes and Unit Operations. Allyn and Bacon Inc., Newton, Massachusetts.
- Holman J P. 1989. Heat Transfer. McGraw Hill Book Co., New Delhi.
- Incropera F P and De Witt D P. 1980. Fundamentals of Heat and Mass Transfer. John Wiley and Sons, New York.
- Gupta C P and Prakash R. 1994. Engineering Heat Transfer. Nem Chand and Bros., Roorkee.

ENH481-ENGLISH IV (3.0)

Class: B.Tech., Status of Course: NF Half Course, Approved since session: 2009-10
Total Credits: 3.0, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 39

- UNIT 1: Writing of Technical Reports and Proposals.
- UNIT 2: Notices, Agenda, Minutes, Manuals and Handbooks.
- UNIT 3: (a) Research Papers, Articles and Abstracts (b) Review writing.
- UNIT 4: Short-Speeches, Debates and Presentation Strategies.
- UNIT 5: Oral Presentation- Interviews, Meetings, Seminars, Conferences and Group Discussions
(Students must be exposed to the Practical aspect of Oral Presentation).

EGC481-INDUSTRIAL VISIT (1.0)

Class: B.Tech., Status of Course: Core Course, Approved since session: 2000-01
Total Credits: 1

- The students of different classes visits various industries to get an exposure to the various operations processes etc. in different types of industries

CAC481-CO-CURRICULAR ACTIVITIES (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session: 2000-01
Total Credits: 3, Periods (55 mts. each)/week: 3 for 26 weeks, Min.pds./sem: 52

- Participation by the students in sports and games, literary, social, cultural and professional activities is compulsory. The proficiency attained in them is evaluated every year and counted in the assessment of the overall performance of the student to encourage a balanced and all-round development of their personality.

GKC481-SC.METH. G.K. & CURRENT AFFAIRS IV (1.0)

Class: BBM/BSSc/BA/BCom/BSc/B.Tech., Status: Core Course, Approved session: 2004-05 Total Credits:1,
Periods(55 mts. each)/week:1(L-1+T-O+P/S-O), Min.pds./sem.:13

- **UNIT 1**

Well known Books and their authors (Indian and Foreign). Foreign Words and phrases in common use. Nobel Prizes.

- **UNIT 2**

History and Important Personalities, Academic and other Institutions, Classical Dances of India, Who is Who?

- **UNIT 3:** Abbreviations, Sobriquets, Superlatives

- **UNIT 4:** Olympic Games - History, Games Played.

- **UNIT 5**

(a) Social Issues and the Environment - From Unsustainable to Sustainable Development, Water Conservation, Rain Water Harvesting, Environmental Ethics, Climate Change, Global Warming (b) Human Population and the Environment - Population Growth, Environment and Human Health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health.

SUGGESTED READING:

- NCERT: TEXT BOOKS ON HISTORY, GEOGRAPHY, CIVICS
- MANORAMA YEAR BOOK
- MR Agarwal: GENERAL KNOWLEDGE DIGEST
- NEWS PAPAERS AND MAGAZINES:
- HINDI & ENGLISH DAILY NEWS PAPERS
- INDIA TODAY

WORK EXPERIENCE COURSES

AEW401-REPAIR OF FARM EQUIPMENT (2.0)

Class: B.Tech., Status of Course: Work Exp. Course, Approved since session:

Total Credits:2, Periods(55 mts. each)/week: 4(L:0+T:0+P:4+S:0), Min.pds./sem.:52

Repair and maintenance of agricultural implements, equipment and tractor.

AEW402-ENERGY AUDITING FOR POLYHOUSE & FARM STRUCTURES (2.0)

Class: B.Tech., Status of Course: Work Exp. Course, Approved since session:

Total Credits:2, Periods(55 mts. each)/week: 4(L:0+T:0+P:4+S:0), Min.pds./sem.:52

1. Heat Load calculation and actual heating load
2. Cooling load Calculation
3. Steam/water vapour requirement of the greenhouse
4. Calculation of thermal efficiency
5. Air requirement of the greenhouse

DPW401-COMMERCIAL ART (2.0)

Class: B.A., Status of Course: WORK EXPERIENCE, Approved since session: 1999-2000

Total Credits: 2, Periods (55 mts. each)/week: 4(L:0+T:0+P:4+S:0), Min.pds./sem.: 52

- 1) Work 1 [12 pds] 2) Work 2 [12 pds] 3) Work 3 [15 pds] 4) Work 4 [5 pds] 5) Visualisation Theory [4 pds] 6) Advertising Theory (not for examination) [4 pds]
- NOTE: (a) Story Board (b) Symbol for public service (c) Packaging (d) Copy Writing (e) Visualisation Theory (f) Advertising theory.

EEW402-REPAIR OF ELECTRICAL EQUIPMENT (2.0)

Class: B.Tech., Status of Course: Work Exp. Course, Approved since session: 2000-01

Total Credits: 2, Periods (55 mts. each)/week: 4 (L:0+T:0+P:4+S:0), Min.pds./sem.: 52

- 1. Importance of electric energy in day to day life. Brief outline of power generation in India. Concept of voltage, current, power, energy. Home wiring-Components used. Simple test instruments. Fuse. Fault finding and repair. Do's and Don'ts with house wiring.
- 2. Effect of current: Heating, lighting and Electromagnetic Effects. Heating appliances. Principle. Construction of electric home appliances based upon electric heating. Fault finding and repair.
- 3. Electric lighting: Types of bulbs. Shades. Systems of lighting. Emergency light. Electric motors. Types of motors used in industry. Fault finding and repair. Rewinding motors and transformers.

WORK EXPERIENCE COURSES (cont...)

EEW403-3D PRINTING TECHNIQUES (2.0)

Class: B.Tech., Status of Course: Work Exp. Course, Approved since session: 2000-01

Total Credits: 2, Periods (55 mts. each)/week: 4 (L:0+T:0+P:4+S:0), Min.pds./sem.: 52

- 1. Screen Printing: Basic Theory. Apparatus. Material. Process. Trouble Shooting. Preparation of Printing Circuit Boards.
- 2. Photostat: Basic Theory. Apparatus. Materials. Process. Trouble Shooting. Blue Printing and Ammonia Printing: Theory. Materials. Process and Practice.

EEW404-MICRO CONTROLLERS & IOT (2.0)

Class: B.Tech., Status of Course: Work Exp. Course, Approved since session: 2017-18

Total Credits: 2, Periods (55 mts. each)/week: 4 (L:0+T:0+P:4+S:0), Min.pds./sem.: 52

- Introduction to Arduino and Shields
- Introduction to ESP8266 and allied boards
- Discuss about battery solution, battery life estimation
- Component selection, Board design, BOM, ordering
- Assemble & Testing
- Connection to IOT data logging services

MEW402-PHOTOGRAPHY (2.0)

Class: B.Tech., Status of Course: Work Exp. Course, Approved since session: 2000-01

Total Credits: 2, Periods (55 mts. each)/week: 4 (L:0+T:0+P:4+S:0), Min.pds./sem.: 26

- Types of photographic cameras. Principal parts and their functions. Types of shutters and their speeds. Diaphragms. Variation of aperture Photographic film, its emulsion and speed. Exposure and its determination. Various types of developers. Techniques of developing and fixing the negatives. Preparing positives by contact printing and making enlargements of different grades of photographic papers. Various methods of retouching and finishing the negative and positive. Introduction to Colour Photography: Making colour enlargements from colour negatives. Special Processes: Micro-photography and photomicrography. Preparing slides by different methods.

WORK EXPERIENCE COURSES (cont...)

MEW403-REFRIGERATION & AIRCONDITIONING (2.0)

Class: B.Tech., Status of Course: Work Exp. Course, Approved since session: 2000-01

Total Credits: 2, Periods (55 mts. each)/week: 4 (L:0+T:0+P:4+S:0), Min.pds./sem.: 26

- 1. Study of Refrigerator and Air-Conditioners.
- 2. Study of Tools.
- 3. Gas Welding & Soldering.
- 4. Detailed study of Compressor.
- 5. Pipe Techniques
- 6. Study of Condensers & Cooling coils.
- 7. Leak testing
- 8. Gas charging.
- 9. Study of Electrical Circuit.

FIFTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM501	FARM MACHINERY AND EQUIPMENT I	3.0	Y	T
AEM502	FARM MACHINERY AND EQUIPMENT I LAB	1.0	Y	P
AEM503	TRACTOR AND AUTOMOBILE ENGINES	3.0	Y	T
AEM504	STATIONARY AND AUTOMOTIVE ENGINES LAB	1.0	Y	P
AEM505	SOIL AND WATER CONSERVATION ENGINEERING	2.0	Y	T
AEM506	AGROECOLOGY AND FOOD SUSTAINABILITY	2.0	Y	T
EEM507	ELECTRICAL TECHNOLOGY	3.0	Y	T
EEM508	ELECTRICAL TECHNOLOGY LAB	1.0	Y	P
EGC581	DESIGN ENGG./ THEME DEVELOP. PROJECT	1.0	N	P
EGC582	PRACTICAL TRAINING	2.0	N	P
CRC581	COMPARATIVE STUDY OF RELIGIONS	2.0	N	T
MAINSTREAM AGRICULTURAL ENGINEERING				
AEM507	CROP PROCESS ENGINEERING	3.0	Y	T
AEM508	PHE LAB	1.0	Y	P
MAM582	PROBABILITY AND STATISTICS	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM509	INTRODUCTION TO DAIRY FARMING	3.0	Y	T
AEM510	DAIRY FARMING LAB	1.0	Y	P
MAM582	PROBABILITY AND STATISTICS	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM511	IOT IN AGRICULTURE SYSTEMS	3.0	Y	T
AEM512	IOT LAB	1.0	Y	P
MAM582	PROBABILITY AND STATISTICS	3.0	Y	T
TOTAL CREDITS		28.0		

AEM501-Farm Machinery and Equipment I (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

Introduction to farm mechanization. Classification of farm machines. Unit operations in crop production. Identification and selection of machines for various operations on the farm. Hitching systems and controls of farm machinery. Calculation of field capacities and field efficiency. Calculations for economics of machinery usage, comparison of ownership with hiring of machines.

- **Unit 2**

Introduction to seed-bed preparation and its classification. Familiarization with land reclamation and earth moving equipment. Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage.

- **Unit 3**

Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. Introduction to tillage machines like mould -board plough, disc plough, chiselplough, sub-soiler, harrows, cultivators, Identification of major functional components. Attachments with tillage machinery.

- **Unit 4**

Introduction to sowing, planting & transplanting equipment. Introduction to seed drills, no-till drills, and strip-till drills. Introduction to planters, bed-planters and other planting equipment. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Adjustments during operation.

AEM501-Farm Machinery and Equipment I (3.0) (cont...)

- **Unit 5**

Introduction to materials used in construction of farm machines. Heat treatment processes and their requirement in farm machines. Properties of materials used for critical and functional components of agricultural machines. Introduction to steels and alloys for agricultural application. Identification of heat treatment processes specially for the agricultural machinery components.

Suggested Readings

- Kepner RA, Roy Barger & EL Barger. Principles of Farm Machinery.
- Smith HP and LH Wilkey. Farm Machinery and Equipment.
- Culpin Claude. Farm Machinery.
- Srivastava AC. Elements of Farm Machinery.
- Lal Radhey and AC Datta. Agricultural Engineering.

AEM502-FARM MACHINERY AND EQUIPMENT I LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Familiarization with different farm implements and tools.
2. Study of hitching systems, Problems on machinery management.
3. Study of primary and secondary tillage machinery – construction, operation, adjustments
4. Primary and secondary tillage machinery - calculations of power and draft requirements.
5. Study of sowing and planting equipment – construction, types,
6. Calculation for calibration and adjustments of sowing and planting equipment.
7. Study of transplanters – paddy, vegetable, etc.
8. Identification of materials of construction in agricultural machinery and study of material properties.

Study of heat treatment processes subjected to critical components of agricultural machinery.

AEM503-TRACTOR AND AUTOMOBILE ENGINES (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 39

- **Unit 1**

Study of 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. General energy equation and heat balance sheet. Study of mechanical, thermal and volumetric efficiencies.

- **Unit 2**

Study of engine components their construction, operating principles and functions. Study of engine strokes and comparison of 2-stroke and 4-stroke engine cycles and CI and SI engines. Study of Engine Valve systems, valve mechanism, Valve timing diagram, and valve clearance adjustment. Study of Cam profile, valve lift and valve opening area.

- **Unit 3**

Study of fuel supply system. Study of fuels, properties of fuels, calculation of air-fuel ratio. Study of tests on fuel for SI and CI engines. Study of detonation and knocking in IC engines. Study of carburetion system, carburetors and their main functional components. Study of fuel injection system – Injection pump, their types, working principles. Fuel injector nozzles – their types and working principle.

- **Unit 4**

Engine governing – need of governors, governor types and governor characteristics. Study of lubrication system – need, types, functional components. Study of lubricants – physical properties, additives and their application. Engine cooling system – need, cooling methods and main functional components. Study of need and type of thermostat valves. Additives in the coolant. Study of radiator efficiency.

AEM503-TRACTOR AND AUTOMOBILE ENGINES (3.0)(cont...)

- **Unit 5**

Study of importance of air cleaning system. Study of types of air cleaners and performance characteristics of various air cleaners. Study of ignition system of SI engines. Study of electrical system including battery, starting motor, battery charging, cut-out, etc. Comparison of dynamo and alternator. Familiarization with the basics of engine testing.

Suggested Readings

- Liljedahl J B and Others. Tractors and Their Power Units.
- Rodichev V and G Rodicheva. Tractors and Automobiles.
- Mathur ML and RP Sharma. A course in Internal Combustion Engines.
- Singh Kirpal. Automobile Engineering – Vol II.
- Heitner Joseph. Automotive Mechanics : Principles and Practicals

AEM504-STATIONARY AND AUTOMOTIVE ENGINES LAB

(1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

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

AEM505-SOIL AND WATER CONSERVATION ENGINEERING (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Unit 1 Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

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

Unit 2

Gullies - Classification, stages of development. Soil loss estimation – Universal soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation by $KE > 25$ and EI30 methods.

Unit 3

Soil erodibility - topography, crop management and conservation practice factors. Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching.

Unit 4

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

Unit 5

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

Suggested Readings

- Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Mahnot S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
- Murthy V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
- Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaca, New York, USA.
- Suresh R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi

AEM506- AGROECOLOGY AND FOOD SUSTAINABILITY (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

UNIT 1 Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

Agroecology-Principles, Concepts, elements, Agroecological basis for conversion to organic management-crop rotation, soil health, crop diversity, indicators of sustainability, ecological processes in sustainable agriculture. Food security via optimization in demand-importance of zero waste concept.

UNIT 2

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

UNIT 3

Land resources of India, Population of land, Land utilization, Net area sown, Changes in cropping pattern, Land degradation. Rainfall forecasting – Adequacy of rainfall for crop growth – Rainfall, Drought and production instability – Irrigation potential, Watersheds and Utilizable surface water – Utilizable water in future (Ground water and surface water).

UNIT 4

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

UNIT 5

Food and Crop production policies – Agricultural credit Policy – Crop insurance – Policies c Natural Resources Use – Policies for sustainable Livelihood – Virtual water and trade Sustainable food Security Action plan.

SUGGESTED READINGS:

- B.K. Desai and Pujari, B.T. Sustainable Agriculture: A Vision for Future, New India Publishing Agency, New Delhi, 2007
- Saroja Raman, Agricultural Sustainability – Principles, Processes and Prospects, CRC Press, 201

EEM507-ELECTRICAL TECHNOLOGY (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2004-05

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem.: 39

• **UNIT 1**

Armature reaction, methods to eliminate undesirable effects of armature reaction. Commutation, resistance commutation, reactance voltage. Starting of DC motor, three point and four point starters, Speed control of DC motor.

• **UNIT 2**

Types, difference between distribution and power transformers. Three phase connections, Parallel operation, and concept of transformer harmonics. Brief idea about cooling methods.

• **UNIT 3**

No load and blocked rotor test, starting methods, methods of speed control, crawling, Double cage induction motor, Applications.

• **UNIT 4**

Single Phase Induction Motor, Shaded pole motor, Reluctance motor, Hysteresis motor operation and applications.

• **UNIT 5**

Types, constructional details, emf equation, synchronous reactance, voltage regulation synchronous impedance method, Power angle characteristics. Power factor improvement. V-curve Applications.

SUGGESTED READING:

- MG Say: ELECTRICAL MACHINERY
- H Cotton: ELECTRICAL MACHINE
- SK Pillai: ELECTRICAL DRIVES

EEM508-ELECTRICAL TECHNOLOGY LAB (1.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2000-01

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem.: 26

1. To study the Magnetization or open circuit characteristics of separately excited D.C. generator and to trace the Hysteresis loop
2. The operation of a D.C. shunt motor starter and to find the variation in speed of a D.C. Shunt motor by (i) Field control (ii) Armature resistance control
3. To study the drum controller and draw the Speed-Torque characteristics at different notches of drum controller of a D.C. Traction motor.
4. To find the efficiency of a single phase Transformer by open circuit and short circuit tests.
5. To find the efficiency of a D.C. motor by Indirect Method (Swinburn's Test)
6. To study the parallel operation of two single phase Transformer.
7. To perform no load and block rotor tests on three phase Induction motor and to determine efficiency.
8. To synchronize two three phase 230 volts, 50 Hz Alternator.
9. To determine the Regulation of Alternator by Synchronous Impedance Method.

EGC581-DESIGN ENGG./THEME DEVELOP. PROJECT (1.0)

Class: B.Tech., Status of Course: Core Course, Approved since session: 2007-08

Total Credits: 1.0, Periods (55 mts. each)/week: 2 (L:0+T:0+P:3+S:0), Min.pds./sem: 39

- The students submit projects connected to Design Engineering Concept and Theme development of real life industrial problems. The evaluation in the following topics will constitute 40% of the total marks in EGC581:
 1. Design methods, Design process, Identification of need, Design concepts, Design decisions and Development of design.
 2. Economics in Engineering Design, Optimization and reliability.

EGC582-PRACTICAL TRAINING (2.0)

Class: B.Tech., Status of Course: Core Course, Approved since session: 2015-16

Total Credits: 2

The students are expected to undergo practical training in different industries allotted to them at different places, in order to acquaint themselves. The various shop floor activities, industrial environment, problems faced in industries. They are required to submit a report on the training and the evaluation through internal and external viva voce.

CRC581-COMPARATIVE STUDY OF RELIGION (2.0)

Status of Course: CORE COURSE, Approved since session: 2014-15

Total Credits: 2, Periods (55mts. each)/week: 2 (L-2+T-0+P/S-0), Min.pds./sem: 26

- UNIT 1: (a) Meaning of the word 'Dharam' and 'Religion'. (b) History of Religion-Scientific Perspective. (c) Religion, Ethics and Values.
- UNIT 2: (a) Pre-Vedic Religion. (b) Concept of Vedic Dieties and Relevance of Yajna. (c) Philosophy of Upanishad. (d) Bhagwadgita in perspective of scientific age. (e) Hinduism-Shaiva, Vaishnav and Shakta (Modern Trends).
- UNIT 3: (a) Bhartiya Darshan (Yoga). (b) Jainism-(Modern Trends and Scientific Perspectives). (c) Buddhism-(Modern Trends and Scientific Perspectives).
- UNIT 4: (a) Zoroastrianism (b) Judaism (c) Christianity-(Modern Trends and Scientific Perspectives). (d) Islam and Sufism-(Modern Trends and Scientific Perspectives).
- UNIT 5: (a) Meaning of the word 'Sant' and Contribution of Sant Kabir and Guru Nanak and Tulsi Sahab in Saint tradition. (b) Radhasoami Faith and its Scientific Relevance. (c) (i) Religion and Modern Scientific age. (ii) Religion and future of Mankind.

SUGGESTED READINGS:

- LM Joshi & Harbans Singh: AN INTRODUCTION TO INDIAN RELIGIONS
- BS Mishra: DISCOURSES ON RADHASOAMI FAITH
- Bhagwandas: ESSENTIAL UNITY OF ALL RELIGION
- Bhagwandas: SAB DHARAMON KI BUNIADI EKTA

MAINSTREAM AGRICULTURAL ENGINEERING

AEM507- CROP PROCESSING ENGINEERING (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 2(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **UNIT I**

Scope and importance of food processing, post harvest losses, principles and methods of food processing. Processing of farm crops; cereals, pulses and oil seeds and their products for food and feed. Processing of animal products, minimal processing, Principle 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.

• **UNIT II**

Theory of mixing, types of mixtures for dry and paste materials, rate of mixing and power requirement, mixing index. Theory of separation, size and unsized separation, types of separators, size of screens, sieve analysis, capacity and effectiveness of screens, pneumatic separation.

• **UNIT III**

Microwave and Dielectric heating. Extrusion processing, Scope & importance of material handling devices, study of different types of material handling systems; belt, chain and screw conveyor, bucket elevator, pneumatic conveying, gravity conveyor- design consideration, capacity and power requirement.

• **UNIT IV**

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, Shred's and Hukill's curve, 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.

MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM507- CROP PROCESSING ENGINEERING (2.0) (cont...)

• **UNIT V**

Types and causes of spoilage in storage, conditions for storage of perishable products, functional requirements of storage, control of temperature and relative humidities inside storage, calculation of refrigeration load; modified atmospheric storage and control of its environment, 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 different methods, warehouse - design and control of environment. Storage condition for various fruits and vegetables under cold and CA storage system. Economic, aspects of storage.

SUGGESTED READING:

- Carl.W.Hall. (1980). Crop drying. AVI Publishing Co. Inc.
- Chakravarty,A . (1995). Post Harvest technology of Cereals,Pulses and Oil Seeds. Oxford and IBH Pub.Co., Calcutta.
- Earle,R.L. (1985). Unit Operations in Food Processing. Pergamon Press, Oxford.U.K.
- Fellows,P . (1993). Food Processing technology, Principles and Practice. Ellis Horwood,USA.
- Handerson,S.M and Perry,R.L. (1955). Agrl.Process Engg. John,Willey & Sons, New York. 6. Majumd

MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM508-PHE LAB (1.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem.: 26

1. Performance evaluation of different types of cleaners and separators,
2. Determination of separation efficiency,
3. Study of different size reduction machines and performance evaluation,
4. Determination of fineness modulus and uniformity index, Study of different types of conveying and elevating equipments,
5. Study of different types of mixers.
6. Measurement of moisture content: dry basis and wet basis, Study on drying characteristics of grains and determination of drying constant, Determination of EMC (Static and dynamic method), Study of various types of dryers,
7. Study of different equipments in rice mills and their performance evaluation,
8. Study of different equipments in pulse mills and their performance evaluation,
9. Study of different equipments in oil mills and their performance evaluation,
10. Type of process flow charts with examples relating to processing of cereals pulses and oil seeds.

MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

MAM582-PROBABILITY AND STATISTICS (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2017-18

Total Credits: 3, Periods (55mts. each)/week: 3, Min pds./sem: 39

[Applicable from session 2018-19]

- **UNIT 1**

Conditional Probability, Baye's Theorem; Measure of central Tendency and dispersion in terms of moments. Mathematical expectations.

- **UNIT 2**

Random Variables: Discrete and continuous, Probability mass/ density function, cumulative mass/density function. Binomial, Poisson and Normal distributions and their applications.

- **UNIT 3**

Sampling distribution, central limit theorem, Estimation; Point and interval estimation using z and t distribution.

- **UNIT 4**

Two types of error, confidence and significance level (small and large samples). Testing of Hypothesis based on means proportions. χ^2 – test as the test of independence and goodness of fit. Test based on variance; F-distribution; one way ANOVA.

- **UNIT 5**

Curve fitting (Method of least square) correlation analysis. Linear regression analysis.

SUGGESTED READING:

- Walpole, R.E., Mayers, R.L., Myers, S.L., and Ye K., 'Probability and Statistics for engineers and scientists', Pearson Education.
- Johnson, R.A., Probability and statistics for Engineers, PHI.
- Kapoor and Saxena, Mathematical Statistics, S. Chand.

DAIRY ENGINEERING SPECIALIZATION

AEM509-INTRODUCTION TO DAIRY FARMING (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 2(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **UNIT 1**

Introduction to Animal Husbandry. Distinguishing characteristics of Indian and exotic breeds of dairy animals. Traditional Systems of cattle keeping, General dairy farm practices. Care of animals at calving and management of neonates.

- **UNIT 2**

Health & Rearing- Digestive system of ruminants, Mammary system, Milk secretion and milk let down. Common disease problems in dairy animals, their prevention and control. Management of lactating animals. Methods of milking, milking procedure and practices for quality milk production. Systems of housing dairy animals. Basic concepts of Calf Rearing, Heifer Rearing, Care of Lactating cattle and Pregnant Cattle, Drying of cattle

- **UNIT 3**

Feed and Nutrition-Feed nutrients required by animal body. Feed resources for milk production and their nutritive values. Measures of feed energy. Nutrients requirements for growth and milk production. Feeding standards.

- **UNIT 4**

Male and female reproductive system. Estrus to reproductive cycle. Ovulation, fertilization, gestation, parturition, pregnancy diagnosis. Systems of breeding and methods of selection of dairy animals. Strategy of cattle improvement; Artificial insemination and embryo transfer and their role in animal improvement. Introduction to biotechniques in dairy animal production.

DAIRY ENGINEERING SPECIALIZATION (cont...)

AEM509-INTRODUCTION TO DAIRY FARMING (3.0) (cont...)

• UNIT 5

Socio-economic and geographical features of Indian dairying., estimates of milk production, utilization and sale; cattle & buffalo population and its distribution; trends in population growth, annual milk production and per capita availability; productivity profile of indigenous dairy stock, industrial by-products of livestock industry. Dairy development; major aided dairy projects; public sector milk supply schemes; co-operative dairy organizations, import substitutions in dairy products. key village scheme and its limitations, intensive cattle development programme concept, approach and achievements. Public sector dairy schemes, National Dairy Development Board, Operation Flood I, II, III, improvements of dairy co-operative organization, Dairy development Corporations, Cooperative Dairy Federations

RECOMMENDED READINGS

- V.M Rao Dairy Farming H.Singh Dairy Farming Eckles, C.H. Dairy Cattle and Milk Production ICAR Hand book of Animal Husbandry

DAIRY ENGINEERING SPECIALIZATION (cont...)

AEM510-DAIRY FARMING LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. To identify appropriate dairy cattle breeds to a specified locality with which the learner is familiar. Justify the selection with regard to climatic condition, locality and market requirements
2. To familiarize with the lactation cycle of a cow. List out the farm husbandry factors and diet plan of cow influence the lactation cycle. Identify the management tasks carried out over a period of 1 month to control the lactation cycle in dairy cattle
3. Identify the pests, diseases and irregularities significant in the locality familiar to the learner. Develop the checklist for the signs of ill health, which should be routinely checked in dairy cattle.
4. Calculate the rations for a dairy cattle according to specified characteristics, such as weight, milk produced and butterfat concentration. List out the nutritional requirement of a typical dairy cattle.
5. To familiarize with the milking systems, storage of milk, quality control of cow and milk and cleaning systems at a dairy farm. Prepare a flow chart of the visited dairy farm operations
6. To familiarize with quality control tests of raw milk. Prepare the record of collected samples with observations.
7. To familiarize with the production of common dairy products, such as pasteurized milk, yogurt, whey drinks, butter, cheese etc. Prepare the flow chart of production processes
8. To familiarize with the marketing plan and quality management systems at the dairy plant.
9. Explain the waste management practices at the visited dairy plant. Identify the loop holes and prepare a plan accordingly.

MAM582-PROBABILITY AND STATISTICS (3.0)

(Common)

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

AEM511-IOT IN AGRICULTURE SYSTEMS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 2(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

An overview of IOT in Agriculture, potential and challenges, Application of IOT in Agriculture, Architecture and component of a typical IOT system

- **Unit 2**

Feeling Things: Typical sensors and sensor nodes used in Agriculture such as weather, soil, air and crop

Tag Things: Technology available to tag things such as bar code, QR code, RFID

- **Unit 3**

Acting Things: Typical actuators in Ag applications

Thinking Things: Embedded and single chip controllers, Setting up a sever for IOT system

- **Unit 4**

MS FarmBeat sensors and microcontrollers, Edge computing for IOT based system- performance and security considerations, IOT in field management (input side)-water management, nutrient management etc.

- **Unit 5**

IOT in field management (output side)-crop harvesting, IOT in livestock management , IOT in smart field equipment, study on working principle of atleast four sensors as a part of IOT.

Suggested Readings

- Erik Brynjolfsson and Andrew McAfee. The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies.
- Cuno Pfister. Getting started with Internet of Things
- Sudha Jamthe. IoT : Disruptions: The Internet of Things - Innovations and Jobs.
- Arshdeep Bahga and Vijay Madisetti. Internet of Things : A hands on Approach
- Pattnaik, Prasant Kumar, Kumar, Raghvendra, Pal, Souvik. Internet of Things and Analytics for Agriculture. Volume2.

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION (cont...)

AEM512-IOT LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

- Part 1: Basic Programming (Existing)
Experiments on Control Structures, Arrays, Linked Lists Structures, Files and Pointers
- Part 2: Sensor based programming using Arduino, Experiments on, Blinking an LED, Reading a Potentiometer, Driving an RGB LED and Multiple LEDs, Push Buttons, Reading a Photo resistor, Obstacle Sensor, Gas Sensor, Fire Sensor, Relay Sensor, Heart Beat Sensor and related real world experiments.

MAM582-PROBABILITY AND STATISTICS (3.0)

(Common)

SIXTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
MEM614	MACHINE DESIGN	3.0	Y	T
MEM615	DESIGN PRACTICE AND CAD APPLICATIONS	2.0	Y	P
AEM601	AGRICULTURAL STRUCTURES AND ENVIRONMENT CONTROL	3.0	Y	T
AEM602	WATERSHED HYDROLOGY, PLANNING AND MANAGEMENT	3.0	Y	T
AEM603	REMOTE SENSING AND GIS	2.0	Y	T
AEM604	SOIL AND WATER LAB	1.0	Y	P
AEM605	FARM MACHINERY AND EQUIPMENT II	2.0	Y	T
AEM606	FARM MACHINERY AND EQUIPMENT II LAB	1.0	Y	P
AEM607	RENEWABLE POWER SOURCES	2.0	Y	T
EGC681	DESIGN ENGG./THEME DEVELOP. PROJECT	1.0	Y	P
CEC681	CULTURAL EDUCATION	2.0	N	T
CAC681	CO-CURRICULAR ACTIVITIES	3.0	N	P
MAINSTREAM AGRICULTURAL ENGINEERING				
AEM608	DRAINAGE ENGINEERING	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
DAIRY ENGINEERING SPECIALIZATION				
AEM611	RHEOLOGY OF DAIRY PRODUCTS	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM612	INFORMATION TECHNOLOGY FOR LAND AND WATER MANAGEMENT	2.0	Y	T
AEM609	EXPERIENTIAL LEARNING	1.0	Y	P
AEM610	STREAM SEMINAR	1.0	Y	P
TOTAL CREDITS		29.0		

MEM614-MACHINE DESIGN (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

- **Unit 1** Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 39
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.
- **Unit 2**
Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of welded subjected to static loads.
- **Unit 3**
Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear and bolted joints subjected to eccentric loading.
- **Unit 4**
Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings.
- **Unit 5**
Design of helical and leaf springs. Design of flat belt and V -belt drives and pulleys. Design of gears. Design of screw motion mechanisms like screw jack, lead screw, etc. Selection of anti-friction bearings.

Suggested Readings

- Jain R K. 2013. Machine Design. Khanna Publishers, 2-B Nath Market, Nai Sarak, New Delhi.
- Khurmi R S and Gupta J K. 2014. A Text Book of Machine Design. S. Chand & Company Ltd., New Delhi.

MEM615-DESIGN PRACTICE AND CAD APPLICATIONS (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 4(L:0+T:0+P:4+S:0), Min.pds./sem:52

1. Application of computers for design. CAD- Overview of CAD window – Explanation of various options on drawing screen.
2. Study of draw and dimension tool bar. Practice on draw and dimension tool bar.
3. Study of OSNAP, line thickness and format tool bar. Practice on OSNAP, line thickness and format tool bar.
4. Practice on mirror, offset and array commands.
5. Practice on trim, extend, chamfer and fillet commands.
6. Practice on copy, move, scale and rotate commands.
7. Drawing of 2 D- drawing using draw tool bar.
8. Practice on creating boundary, region, hatch and gradient commands.
9. Practice on Editing polyline- PEDIT and Explode commands.
10. Setting of view ports for sketched drawings. Printing of selected view ports in various paper sizes.
11. 2D- drawing of machine parts with all dimensions and allowances- Foot step bearing and knuckle joint.
12. Sectioning of foot step bearing and stuffing box.
13. Drawing of hexagonal, nut and bolt and other machine parts.
14. Practice on 3-D commands- Extrusion and loft.
15. Practice on 3-D commands-on sweep and press pull.
16. Practice on 3-D Commands- revolving and joining.
17. Demonstration on CNC machine and simple problems.

Suggested Readings

- Rao P.N.. 2002. CAD/CAM Principles and Applications. McGraw-Hill Education Pvt. Ltd., New Delhi.
- Sareen Kuldeep and Chandan Deep Grewal. 2010. CAD/CAM Theory and Practice. S.Chand & Company Ltd., New Delhi.

AEM601-AGRICULTURAL STRUCTURES AND ENVIRONMENTAL CONTROL (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

- **Unit 1** Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52
Planning and layout of farmstead. Scope, importance and need for environmental control, physiological reaction of livestock environmental factors, environmental control systems and their design, control of temperature, humidity and other air constituents by ventilation and other methods,
- **Unit 2**
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, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc.
- **Unit 3**
Storage of grains, Causes of spoilage, Water activity for low and high moisture food and its limits for storage, Moisture and temperature changes in grain bins; Traditional storage structures and their improvements, Improved storage structures (CAP, hermetic storage, Pusa bin, RCC ring bins), Design consideration for grain storage godowns, Bag storage structures, Shallow and Deep bin, Calculation of pressure in bins, Storage of seeds.
- **Unit 4**
Rural living and development, 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.
- **Unit 5**
Site and orientation of building in regard to sanitation, community sanitation system; sewage system and its design, cost and maintenance, design of septic tank for small family. Estimation of domestic power requirement, source of power supply and electrification of rural housing.

Suggested Readings

- Pandey P.H. Principles and practices of Agricultural Structures and Environmental Control, Kalyani Publishers, Ludhiana.
- Ojha T.P and Michael A.M. Principles of Agricultural Engineering, Vol. I, Jain Brothers, Karol Bag, New Delhi.
- Nathanson J.A. Basic Environmental Technology, Prentice Hall of India, New Delhi.
- Venugopal Rao P. Text Book of Environmental Engineering, Prentice Hall of India, New Delhi.

AEM602-WATERSHED HYDROLOGY, PLANNING AND MANAGEMENT (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Unit 1 Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Hydrologic cycle, precipitation and its forms, rainfall measurement and estimation of mean rainfall, frequency analysis of point rainfall. Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship. Hydrologic processes-Interception, infiltration -factors influencing, measurement and indices. Evaporation - Estimation and measurement.

Unit 2

Runoff - Factors affecting, measurement, stage - discharge rating curve, estimation of peak runoff rate and volume, Rational method, Cook's method and SCS curve number method. Geomorphology of watersheds – Linear, aerial and relief aspects of watersheds- stream order, drainage density and stream frequency.

Unit 3

Hydrograph - Components, base flow separation, unit hydrograph theory, S-curve, synthetic hydrograph, applications and limitations. Stream gauging - discharge rating curves, flood peak, design flood and computation of probable flood. Flood routing – channel and reservoir routing. Drought – classification, causes and impacts, drought management strategy.

Unit 4

Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, soil characteristics, vegetative cover, land use practices and socio-economic factors. Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index. Water budgeting in a watershed.

AEM602-WATERSHED HYDROLOGY, PLANNING AND MANAGEMENT (3.0) (cont...)

• **Unit 5**

Dry farming techniques, Integrated watershed management - concept, components, Participatory watershed management - role of watershed associations, user groups and self-help groups. People's participation in watershed management, Estimate preparation for watershed projects- Detailed estimate-Analysis of rates-Abstract of estimate. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis. Preparation of detailed project report (DPR) for watershed projects.

Suggested Readings

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

AEM603-REMOTE SENSING AND GIS (2).

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39)

- **Unit1**

Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows.

- **Unit2**

Principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap.

- **Unit3**

Stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements; photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photograph.

- **Unit4**

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

- **Unit5**

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

Suggested Readings

- Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
- Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Pubn Agency, New Delhi.

AEM604-SOIL AND WATER LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Study of different types and forms of water erosion.
2. Exercises on computation of rainfall erosivity index.
3. Computation of soil erodibility index in soil loss estimation.
4. Exercises on soil loss estimation/measuring techniques.
5. Study of rainfall simulator for erosion assessment.
6. Estimation of sediment rate using Coshocton wheel sampler and multi-slot depositor. Determination of sediment concentration through oven dry method.
7. Design and layout of contour bunds / graded bunds.
8. Design and layout of broad base terraces / bench terraces.
9. Design of vegetative waterways.
10. Study of different types of farm ponds / Computation of storage capacity of embankment type of farm ponds. Design of dugout farm ponds. Design of percolation pond and nala bunds.
11. Runoff measurement using H-flume.
12. Exercise on hydraulic jump / Hydrologic, hydraulic and structural design of drop spillway and stability analysis.
13. Practice on softwares for design of soil and water conservation structures.
14. Field visit to watershed project areas treated with soil and water conservation measures / structures.

AEM605-FARM MACHINERY AND EQUIPMENT-II (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

- **Unit 1** Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

Introduction to plant protection equipment – sprayers and dusters. Classification of sprayers and sprays. Types of nozzles. Calculations for calibration of sprayers and chemical application rates. Introduction to interculture equipment.

- **Unit 2**

Use of weeders – manual and powered. Study of functional requirements of weeders and main components. Familiarization of fertilizer application equipment. Study of harvesting operation – harvesting methods, harvesting terminology. Study of mowers – types, constructional details, working and adjustments.

- **Unit 3**

Study of shear type harvesting devices – cutter bar, inertial forces, counter balancing, terminology, cutting pattern. Study of reapers, binders and windrowers – principle of operation and constructional details. Importance of hay conditioning, methods of hay conditioning, and calculation of moisture content of hay. Introduction to threshing systems – manual and mechanical systems. Types of threshing drums and their applications.

- **Unit 4**

Types of threshers- tangential and axial, their constructional details and cleaning systems. Study of factors affecting thresher performance. Study of grain combines, combine terminology, classification of grain combines, study of material flow in combines. Computation of combine losses, study of combine troubles and troubleshooting. Study of chaff cutters and capacity calculations. Study of straw combines – working principle and constructional details.

- **Unit 5**

Study of root crop diggers – principle of operation, blade adjustment and approach angle, and calculation of material handled. Study of potato and groundnut diggers. Study of Cotton harvesting – Cotton harvesting mechanisms, study of cotton pickers and strippers, functional components. Study of maize harvesting combines. Introduction to vegetables and fruit harvesting equipment and tools.

Suggested Readings

- Kepner RA, Roy Barger & EL Barger. Principles of Farm Machinery.
- Smith HP and LH Wilkey. Farm Machinery and Equipment.

AEM606-FARM MACHINERY AND EQUIPMENT-II LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Familiarization with plant protection and interculture equipment.
2. Study of sprayers, types, functional components.
3. Study of dusters, types and functional components.
4. Calculations for chemical application rates.
5. Study of nozzle types and spread pattern using patternator.
6. Familiarization with manual and powered weeding equipment and identification of functional components.
7. Study of fertilizer application equipment including manure spreaders and fertilizer broadcasters.
8. Study of various types of mowers, reaper, reaper binder. Study of functional components of mowers and reapers.
9. Familiarization with threshing systems, cleaning systems in threshers. Calculations of losses in threshers.
10. Familiarization with functional units of Grain combines and their types. Calculations for grain losses in a combine.
11. Study of root crop diggers and familiarization with the functional units and attachments.
12. Familiarization with the working of cotton and maize harvesters.
13. Familiarization with vegetable and fruit harvesters.

AEM607-RENEWABLE POWER SOURCES (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

- **Unit 1**

Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. OTEC, MHD, hydrogen and fuel cell technology. Fuel cells and its associated parameters.

- **Unit 2**

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

- **Unit 3**

Solar thermal and photovoltaic Systems for power generation. Central receiver (Chimney) and distributed type solar power plant

- **Unit 4**

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

- **Unit 5**

(Practicals) Performance evaluation of solar water heater and solar cooker; Characteristics of solar photovoltaic panel; evaluation of solar air heater/dryer; Performance evaluations: biomass gasifier engine system (throatless & downdraft), fixed dome type biogas plant and floating drum type biogas plant; Estimation of calorific value of biogas & producer gas; Testing of diesel engine operation using dual fuel and gas alone.

Suggested Readings

- Bansal N.K., Kleemann M. & Meliss Michael. 1990. Renewable Energy Sources & Conversion Technology; Tata Mecgrow Publishing Company, New Delhi.
- Rathore N. S., Kurchania A. K. & N.L. Panwar. 2007. Non Conventional Energy Sources, Himanshu Publications.
- Mathur A.N. & N.S. Rathore. Renewable Energy Sources Bohra Ganesh Publications, Udaipur.

EGC681-DESIGN ENGG./THEME DEVELOP. PROJECT (1.0)

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01

Total Credits:1.0, Periods(55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem: 39

The students submit projects connected to Design Engineering Concept and Theme development of real life industrial problems.

CEC681-CULTURAL EDUCATION (2.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 1999-2000

Total Credits:2, Periods(55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 26

1. Introduction: (a) What is culture (b) Meaning and scope of Indian culture (c) The composite nature of Indian culture.
2. Pre-Vedic Harappan Culture.
3. Indian Literature: (a) Indian language (b) Vedic language (c) Epics & Purans (d) Major authors in classical Sanskrit literature (e) Buddhist literature, Pali Tripitakas, Pali literature (f) Buddhist literature of Mahayan Sutra (g) Jain literature of Agamas (h) Main currents of Bhakti literature.
4. State and Society: (a) Ideals of Kinship (b) Republican traditions (c) Education d) Marriage and family life (e) Varna organisation-Caste system (f) Position of women (g) Religion, state & society.
5. ARTS: (a) Architecture- (i) Stupas and Viharas (ii) Temples (iii) Mosques and Palaces (b) Sculpture and paintings (c) Music and Dance (d) Sports and entertainment (e) Art of Warfare.
6. UNITY IN DIVERSITY: (a) Non-Aryan elements (b) West-Asian elements (c) Aryan elements (d) European elements.

SUGGESTED READINGS:

- Basham AL: THE WONDER THAT WAS INDIA Rawlinsson: CULTURAL HISTORY OF INDIA
- Stella Kramrisch: INDIAN SCULPTURE Coomaraswamy AK: HISTORY OF INDIAN & UNCONESIAN ART
- Coomaraswamy AK: ARTS & CRAFTS OF INDIA Percy Brown: INDIAN PAINTINGS
- Chatterjee Suniti Kumar: LANGUAGES AND LITERATURE OF MODERN INDIA V Raghvan: INDIAN HERITAGE

CAC681-CO-CURRICULAR ACTIVITIES (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2000-01

Total Credits:3, Periods(55 mts. each)/week: 3 for 26 weeks, Min.pds./sem: 52

Participation by the students in sports and games, literary, social, cultural and professional activities is compulsory. The proficiency attained in them is evaluated every year and counted in the assessment of the overall performance of the student to encourage a balanced and all-round development of their personality.

MAINSTREAM AGRICULTURAL ENGINEERING

AEM608-DRAINAGE ENGINEERING (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

- **Unit 1**

Water logging- causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state.

- **Unit 2**

Surface drainage coefficient, types of surface drainage, design of surface drains; sub-surface drainage: purpose and benefits, investigations of design parameters-hydraulic conductivity, drainable porosity, water table; derivation of Hooghoudt's and Ernst's drain spacing equations.

- **Unit 3**

Subsurface drainage system: Design of subsurface drainage system; drainage materials, drainage pipes, drain envelope; layout, construction and installation of drains.

- **Unit 4**

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

- **Unit 5**

Special drainage systems: vertical drainage; bio-drainage; mole drains. Salt balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water.

Suggested Readings

- Bhattacharya AK and Michael AM. 2013. Land Drainage, Principles , Methods and Applications.
- Vikas Publication House, Noida (UP).
- Ritzema H.P.1994 Drainage Principles and Applications, ILRI Publication 16, Second Edition (Completely Revised).

MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM609-EXPERIENTIAL LEARNING (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits:1.0, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:52

Visit to IARI, ICAR facilities, Time series climate data analyses using programming language, To calculate crop water requirement by real time soil moisture measurement, Exercises on running computer software packages dealing with water balance, crop production, land development, land and water allocation, watershed analysis etc, to conduct a GPS survey to locate different water bodies and different land use practices in the campus, to identify drought prone and flood areas using RS and GIS, Understanding operation and maintenance of Tractor, Autonomous vehicles and Unmanned Aerial Vehicles (UAVs) for farming, AI and related high level languages like Java/python Familiarization with different makes and models of agricultural tractors. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems. Study of maintenance points to be checked before starting a tractor. Familiarization with controls on a tractor. Safety rules and precautions to be observed while driving a tractor. Driving practice of tractor. Practice of operating a tillage tool (mould-board plough/ disc plough) and their adjustment in the field. Study of field patterns while operating a tillage implement. Hitching & De-hitching of mounted and trail type implement to the tractor. Driving practice with a trail type trolley – forward and in reverse direction. Introduction to tractor maintenance – precautionary and break-down maintenance. Tractor starting with low battery charge. Introduction to trouble shooting in tractors. Familiarization with tools for general and special maintenance. Introduction to scheduled maintenance after 10, 100, 300, 600, 900 and 1200 hours of operation. Safety hints. Top end overhauling. Fuel saving tips. Preparing the tractor for storage. Care and maintenance procedure of agricultural machinery during operation and off-season. Repair and maintenance of implements – adjustment of functional parameters in tillage implements. Replacement of broken components in tillage implements. Replacement of furrow openers and change of blades of rotavators. Maintenance of cutter bar in a reaper. Adjustments in a thresher for different crops. Replacement of V-belts on implements. Setting of agricultural machinery workshop. Service, maintenance, repair and operation of pumps, electric motors and different irrigation equipment.

MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM610-STREAM SEMINAR (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2 (L:0+T:0+P:0+S:2), Min.pds./sem: 26

The students will present seminar on the topics of their interest pertaining to agricultural engineering in their stream of specialization. The presentation will be evaluated based on topic selection presentation, response to questions during discussion.

DAIRY ENGINEERING SPECIALIZATION

AEM611-RHEOLOGY OF DAIRY PRODUCTS (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

• UNIT 1

Introduction to rheology of foods: Definition of „texture“, „rheology“ and „psychophysics“–their structural basis; physical considerations in study of foods; salient definitions– Stress tensor and different kinds of stresses.

• UNIT 2

Rheological classification of Fluid Foods : Shear-rate dependence and time dependence of the flow-curve; Non-Newtonian fluids; thixotropy; Mechanisms and relevant models for non-Newtonian flow; Effect of temperature; Compositional factors affecting flow behaviour; Viscosity of food dispersions– dilute and semi-dilute systems, concentration effects.

• UNIT 3

Comparative assessment of different types of Viscometers, and their Merits and Limitations: Co-axial cylinders, Spindle- or Impeller-type viscometers, Cone-plate viscometer, Capillary viscometers, Falling-sphere viscometer, Vibratory viscometers, Extrusion viscometer, Orifice viscometer.

• UNIT 4

Rheology of semi-solid and solid food ; Rheological characterization of foods in terms of stress-strain relationship; Viscoelasticity; Transient tests - Creep Compliance and Stress Relaxation; mechanical models for viscoelastic foods: Maxwell, Kelvin, Burgers and generalized models and their application; Dynamic measurement of viscoelasticity.

• UNIT 5

Large Deformations and failure in foods: Definitions of fracture, rupture and other related phenomena; Texture Profile Analysis; Instrumental measurements – Empirical and Fundamental methods; Rheometers and Texture Analyzers; Measurement of Extensional viscosity; Acoustic measurements on crunchy foods. Rheological and textural properties of selected dairy products: Measurement modes and techniques; Effect of processing and additives (stabilizers and emulsifiers) on food product rheology; Relationship between instrumental and sensory data.

SUGGESTED READINGS

- Barbosa-Canovas GV, Kokini JL, Ma L & Ibarz A. 1997. *Rheology of Semi-liquid foods*. *Adv. Food & Nutr. Res.*, 39:1-69.
- DeMann JM, Voisey PW, Rasper VF & Stanley DW. 1976. *Rheology and Texture in Food Quality*. AVI Publ. NDRI. 1996. *Sensory Evaluation & Rheology of Milk & Milk Products*. Lecture Compendium, CAS/DT Short Course, Aug. 22-Sept.13, 1996.

DAIRY ENGINEERING SPECIALIZATION (cont...)

AEM609-EXPERIENTIAL LEARNING (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits:1.0, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:52

1. Visit to IARI, ICAR facilities
2. Understanding operation and maintenance of RFID,HPP(High Pressure Processing),PulseElectric Field(PEF)
3. Nano and imaging sensors in dairy and food processing
4. High level languages like Java/python
5. Maintenance and operation of R & AC equipment used in Dairy Plant
6. Operation and maintenance of different machinery and equipment used in Food Processing industries.

AEM610-STREAM SEMINAR (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2 (L:0+T:0+P:0+S:2), Min.pds./sem: 26

The students will present seminar on the topics of their interest pertaining to agricultural engineering in their stream of specialization. The presentation will be evaluated based on topic selection presentation, response to questions during discussion.

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

AEM612-INFORMATION TECHNOLOGY FOR LAND AND WATER MANAGEMENT (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

• **Unit 1**

Concept of Information Technology (IT) and its application potential. Role of IT in natural resources management. Existing system of information generation and organizations involved in the field of land and water management.

• **Unit 2**

Application and production of multimedia. Internet application tools and web technology. Networking system of information.

• **Unit 3**

Problems and prospects of new information and communication technology. Development of database concept for effective natural resources management. Application of remote sensing, geographic information system (GIS) and GPS. Rational data base management system.

• **Unit 4**

Object oriented approaches. Information system, decision support systems and expert systems. Agricultural information management systems - use of mathematical models and programmes.

• **Unit 5**

Application of decision support systems, multi sensor data loggers and overview of software packages in natural resource management. Video-conferencing of scientific information.

Suggested Readings

- Climate-Smart Agriculture – Source Book. 2013. Food and Agriculture Organization, Rome.
- Daniel P. Loucks and Eelco van Beek. 2005. Water Resources Systems Planning and Management - An Introduction to Methods, Models and Applications. UNESCO, Paris.
- FAO. 1998. Land and Water Resources Information Systems. FAO Land and Water Bulletin 7, Rome.
- Soam, S.K., P.D. Sreekanth and N.H. Rao (Eds.). 2013. Geospatial Technologies for Natural Resources Management. New India Publishing Agency, Delhi.

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION (cont...)

AEM609-EXPERIENTISAL LEARNING (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits:1.0, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:52

- Visit to IARI, ICAR facilities, SWOT analysis to start a food processing business, Preparation of business proposal for small scale industry, Analysis of financial statements (Balance Sheet, Profit loss statement), Application of project appraisal technique, Formulation of project feasibility reports, Individual Presentation of model project proposals in the class, Group Presentation of model project proposals in the class.

AEM610-STREAM SEMINAR (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2 (L:0+T:0+P:0+S:2), Min.pds./sem: 26

The students will present seminar on the topics of their interest pertaining to agricultural engineering in their stream of specialization. The presentation will be evaluated based on topic selection presentation, response to questions during discussion.

SEVENTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM701	AGRICULTURAL ENGINEERING PROJECT I	3.0	N	P
AEM702	SEMINARS	1.0	N	P
AEM703	FARM BUSINESS MANAGEMENT AND VILLAGE INDUSTRIES	3.0	Y	T
AEM704	PROFESSIONAL ETHICS AND CONCIOUSNESS	2.0	Y	T
AEM705	MINOR PROJECT-I	1.0	N	P
MEM703	REFRIGERATION AND AIR CONDITIONING	3.0	Y	T
MEM704	THERMAL ENGINEERING LAB II	1.0	Y	P
EGC781	CO-OP TRAINING AND EXPERIENTIAL LEARNING	4.0	Y	P
#	STREAM WISE CORE COURSES	7.0	Y	T
*	STREAM WISE OPTIONAL COURSES	3.0	Y	T
TOTAL CREDITS		28.0		

SEVENTH SEMESTER (cont...)

Stream-wise CORE Courses (#):

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM706	WATER HARVESTING AND SOIL CONSERVATION STRUCTURES	3.0	Y	T
AEM707	GROUND WATER WELL AND PUMPS	3.0	Y	T
AEM708	HYDROLOGY LAB	1.0	Y	P
DAIRY ENGINEERING SPECIALIZATION				
AEM709	FOOD QUALITY AND CONTROL	3.0	Y	T
AEM710	DAIRY ENGINEERING	3.0	Y	T
AEM711	DAIRY ENGINEERING LAB	1.0	Y	P
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM712	AGRICULTURE MARKETING TRADE & PRICES	3.0	Y	T
AEM713	AI AND MACHINE LEARNING IN AGRICULTURE	3.0	Y	T
AEM714	MODERN AGRITECH LAB	1.0	Y	P

SEVENTH SEMESTER (cont...)

Stream-wise OPTIONAL Courses any one of the following (*):

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM715	BIO ENERGY SYSTEMS	3.0	Y	T
AEM716	SEED PROCESSING TECHNOLOGY	3.0	Y	T
AEM717	DESIGN OF STRUCTURES	3.0	Y	T
AEM718	AGRICULTURE DATA ANALYTICS	3.0	Y	T
AEM719	FARM MACHINERY DESIGN AND PRODUCTION	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P
DAIRY ENGINEERING SPECIALIZATION				
AEM721	NUTRITIONAL MANAGEMENT IN DAIRY FARM	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM718	AGRICULTURE DATA ANALYTICS	3.0	Y	T
AEM720	HUMAN ENGINEERING AND SAFETY	3.0	Y	T
AEM722	UAV IN AGRICULTURE	3.0	Y	T
AEM723	SENSORS AND MICRO CONTROLLERS	3.0	Y	T
MEM728	ADDITIVE MANUFACT. FOR 3D PRINTING	2.0	Y	T
MEM729	ADD. MANUFACT. FOR 3D PRINTING LAB.	1.0	Y	P

AEM701-AGRICULTURAL ENGINEERING PROJECT I (3.0)

Class: B.Tech., Status of Course: HALF COURSE,, Approved since session:

Total Credits:3, Periods (55 mts. Each)/week:6(L:0+T:0+P:6+S:0), Min.pds./sem.: 78

At the final year level the students in a group of 3 or 4 undertake project work in different area of specialisation as Farm machinery and farm power, Soil and water conservation, Irrigation and drainage engineering, applications of renewable energy in agriculture, dairy technology and food engineering, etc. This involves fabrication & testing of software development and their application etc.

AEM702-SEMINARS (1.0)

Class: B.Tech., Status of Course: HALF COURSE,, Approved since session:

Total Credits:1, Periods (55 mts. Each)/week:2 (L:0+T:0+P:0+S:2), Min.pds./sem.: 26

Students prepare term papers on topics allotted to them by their respective supervisor. They present it in Seminars.

AEM703-FARM BUSINESS MANAGEMENT AND VILLAGE INDUSTRIES (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

• **UNIT 1**

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

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

• **UNIT 2**

Principles, forms of agri-business organizations, Management approaches – Profit Centred Approach, Management by approach and quality circles. Strength, Weakness, Opportunity and Threat (SWOT) Analysis. Agro-inputs and products inventory management – raw material procurement, inventory types and costs.

• **UNIT 3**

Marketing management – Marketing environment, marketing mix – Input marketing promotion activities. product pricing methods, Agricultural input marketing firms. Financial management. Acquiring capital – budget analysis. Agricultural inputs retailing, types of distribution channels – Return on Investment

• **UNIT 4**

Village industries for prosperity of rural poor. Work of different agencies-KVIC, handicraft & other boards. Small scale industries. Definition. Resource based and demand based industries. Market survey and analysis. Process flow chart. Quality standards & control.

• **UNIT 5**

Cost of project. Fixed and working capital requirement. Cost of production and profitability. Break even analysis. Cash flow analysis. Role of Govt. Agencies. Incentives. Backward areas. Reserved items. DIC. SISI. SIDO. National bed banks etc. Agriculture policies, Taxation system in agriculture.

SUGGESTED READINGS

- Himanshu, “Agri Business Management – Problems and prospects”, Ritu Publications, Jaipur, 2005
- Smita Diwase, “Indian Agriculture and Agribusiness Management”, Krishi Resource Management Network, Pune, 2004

AEM704-PROFESSIONAL ETHICS AND CONSCIOUSNESS (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

- **UNIT 1**

Moral values and ethics: Integrity, work ethic, service learning; civic virtues like caring, sharing, honesty, courage, valuing time, cooperation, commitment, empathy, self- confidence, spirituality and stress management

- **UNIT 2**

Variety of moral issues, types of inquiry, moral dilemma, Moral Autonomy: Kohl Berg theory, Gillian's theory, consensus and controversy, theories about right action, customs and religion, uses of ethical theories, engineers as responsible experimenters, a balanced outlook on law.

- **UNIT 3**

Safety and risk: assessment of safety and risk, risk benefit analysis and reducing risk, respect for authority, collective bargaining, confidentiality, conflict of interest, occupational crime. RIGHTS: Professional rights, employee rights, intellectual property rights(ITR), discrimination.

- **UNIT 4**

Multinational Corporations, environmental ethics, computer ethics, weapon development, engineer as manager, consulting engineers and advisors, moral leadership, corporate social responsibility

- **UNIT 5**

Basics of consciousness, different levels of consciousness, mystery of consciousness, requirement for creating consciousness system, consciousness and contemporary system theory, machine consciousness, neuro biological concepts in consciousness, aim of life and the concept of pleasure and pain, brain-mined relationship for consciousness.

SUGGESTED READING:

- Mike W, Martin and Roland Schinzinger, Ethics in engineering, Tata Mc Graw Hill, New Delhi, 2003
- Govind Rajan M, Natrajan S, Senthil Kumar VS, Engineering ethics, Prentice Hall of India, New Delhi, 2004

MEM703-REFRIGERATION AND AIR CONDITIONING (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2013-14

Total Credits:3, Periods (55 mts. each)/week:3(L:3+T:1+P:0+S:0), Min.pds./sem.: 52

• UNIT 1

Introduction. Methods of Refrigeration (change in phase, expansion of liquids, adiabatic expansion of a gas, thermoelectric cooling, adiabatic demagnetization, ice refrigeration, evaporative refrigeration, steam jet refrigeration). Carnot refrigeration cycle, COP, concept of heat pump, Unit of refrigeration Capacity. Applications of refrigeration. Air refrigeration: Air refrigeration cycle. Bell Coleman air refrigerator, Advantages of using air refrigeration in Aircraft. Simple, Bootstrap, Regenerative and reduced ambient type systems. Performance of air refrigeration systems, Comparison of different air cooling systems for aircraft.

• UNIT 2

Simple vapour compression refrigeration system, different compression processes (wet, dry and saturated compression, super heated compression), Coefficient of performance with and without superheating and under-cooling. Compressor volumetric efficiency. Application of T-S diagram and P-H charts. Effects of operating conditions on the performance of the system. Advantages and disadvantages of vapour compression system over air refrigeration system. Important refrigerants, nomenclature and their properties. Insulating materials and their properties and applications. Leak detection. Charging of refrigerants.

• UNIT 3

Methods of improving COP, flash chamber, flash inter cooler, Compound vapour compression system with and without inter-cooling for single and multi evaporators. Cascading. Manufacturing of dry ice. Refrigeration equipment-expansion/throttling devices. Refrigeration load calculations. Absorption system: Simple and improved absorption systems. COP of absorption system, Electrolux system, Lithium bromide water absorption system.

MEM703-REFRIGERATION AND AIR CONDITIONING (3.0)

(cont...)

- **UNIT 4**

Psychrometric properties of air. Adiabatic saturation temperature. Psychrometric charts. Locating state points. Process of heating, cooling, humidification and de-humidification on charts. Chemical de-humidification. Air conditioning: Factors affecting air conditioning systems. Industrial and comfort air conditioning. Human requirements of Comfort. Comfort charts. Ventilation requirements. Applications of air conditioning, Automotive Air-Conditioning.

- **UNIT 5**

Air conditioning equipments and system layout. Distribution of air through ducts, grills, filters, etc. Simple automatic system for temperature and humidity using face and bypass damper and reheat method. INDUSTRIAL AND COMMERCIAL APPLICATION: Transport air conditioning, evaporative condensers, cooling towers, heat pumps.

SUGGESTED READING:

- S Domkundwar & SC Arora: A COURSE IN REFRIGERATION & AIR CONDITIONING
- Stoecker: REFRIGERATION AND AIR CONDITIONING
- Manohar Lal: REFRIGERATION AND AIR CONDITIONING

MEM704-THERMAL ENGINEERING LAB II (1.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2000-01
Total Credits:1, Periods (55 mts. each)/week:2(L:0+T:0+P:1+S:1), Min.pds./sem.: 26

- Study of Heat pump.
- Study of refrigerators sealed unit and open unit.
- Study of AC tutor
- To determine COP of house hold refrigerator.
- To determine COP of AC tutor.
- Study of ice plant and cold storage.
- Study of cooling tower.

EGC781-CO-OP TRAINING AND EXPERIENTIAL LEARNING (4.0)

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01

Total Credits:4

- The students are expected to undergo practical training in different industries allotted to them at different places, in order to acquaint themselves to various shop floor activities, industrial environment and problems faced in industries. They are required to submit a report on the training and the evaluation through internal and external viva voce.

AEM705-MINOR PROJECT-I (1.0)

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01
Total Credits:1, Periods (55 mts. Each)/week:2 (L:0+T:0+P:2+S:0), Min.pds./sem.: 26

1. Exposure to agritech startups, listing the startups and case studies
2. To increase the farm productivity that will increase the farms income
3. Make innovative farm equipments for small and medium farmer
4. To develop cost effective storage system for vegetables and fruits at small scale
5. Visit to IARI/ICAR/some reputed agricultural facilities

MAINSTREAM AGRICULTURAL ENGINEERING

AEM706-WATER HARVESTING AND SOIL CONSERVATION STRUCTURES (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

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

• **Unit 2**

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

• **Unit 3**

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

• **Unit 4**

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

• **Unit 5**

Chute spillway - description, components, energy dissipaters, design criteria of Saint Antony Falls (SAF) stilling basin and its limitations. Drop inlet spillway - description, functional use and design criteria.

Suggested Readings

- Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Michael A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM707-GROUND WATER WELLS AND PUMPS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

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

- **Unit 2**

Groundwater exploration techniques; methods of drilling of wells: percussion, rotary, reverse rotary; design of tubewell and gravel pack, installation of well screen, completion and development of well;

- **Unit 3**

Groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's, Theis recovery method; well interference, multiple well systems, estimation of ground water potential, quality of ground water; Artificial groundwater recharge techniques;

- **Unit 4**

Pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting, performance curves, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics;

- **Unit 5**

Hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

Suggested Readings

- Michael A.M. Khamar SD, and SK Sondhi, 2008, Water Well and Pumps, 2nd Edition, Tata Mc Graw Hill

MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM708-HYDROLOGY LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

1. Visit to meteorological observatory, prepare the layout and study different instruments
2. Measurement of rainfall by recording and non-recording type rain gauges,
3. Sieve analysis for gravel and well screens design;
4. Study of artificial ground water recharge structures;
5. Testing of centrifugal pump and study of cavitations;
6. study and testing of hydraulic ram;
7. In-situ measurement of hydraulic conductivity by single auger hole and inverse auger hole method
8. Design of surface drainage system and cost analysis
9. Preparation of contour map and isobath map
10. Delineation of watershed and determination of watershed characteristics

DAIRY ENGINEERING SPECIALIZATION

AEM709-FOOD QUALITY AND CONTROL (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

Basics of Food Science and Food Analysis, Concept, objectives and need of food quality. Measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition.

- **Unit 2**

Sampling; purpose, sampling techniques, sampling procedures for liquid, powdered and granular materials, Quality control, Quality control tools, Statistical quality control, Sensory evaluation methods

- **Unit 3**

Panel selection methods, Interpretation of sensory results. Instrumental method for testing quality. Food adulteration and food safety. TQM and TQC, consumer preferences and acceptance,

- **Unit 4**

Food Safety Management Systems GAP, GHP, GMP, Hazards and HACCP (Hazard analysis and critical control point), Sanitation in food industry (SSOP),

- **Unit 5**

Food Laws and Regulations in India, FSSAI, Food grades and standards BIS, AGMARK, PFA, FPO, ISO 9000, 22000 Series. CAC (Codex Alimentarius Commission), Traceability and Quality Assurance system in a process plant, Bio safety and Bioterrorism.

Suggested Readings

- Ranganna S. Hand book of Analysis and Quality Control for Fruit and Vegetable Products.
- Sharma Avanthi. A text book of Food Science and Technology.

DAIRY ENGINEERING SPECIALIZATION (cont...)

AEM710-DAIRY ENGINEERING (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

Deterioration in food products and their controls, Physical, chemical and biological methods of food preservation. Nanotechnology: History, fundamental concepts, tools and techniques nanomaterials, applications in food packaging and products, implications, environmental impact of nanomaterials and their potential effects on global economics, regulation of nanotechnology. (Practicals) Visit to multi-product dairy plant.

- **Unit 2**

Dairy development in India, Engineering, thermal and chemical properties of milk and milk products, Process flow charts for product manufacture, Unit operation of various dairy and food processing systems. Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation.(Practicals) Study of pasteurizers, Study of sterilizers, Study of homogenizers.

- **Unit 3**

Preparation methods and equipment for manufacture of cheese, paneer, butter and ice cream, Filling and packaging of milk and milk products. Dairy plant design and layout, Plant utilities.(Practicals) Study of separators, Study of butter churns, Visit to Food industry, Estimation of refrigeration requirements in dairy & food plant.

DAIRY ENGINEERING SPECIALIZATION (cont...)

AEM710-DAIRY ENGINEERING (3.0) (cont...)

• **Unit 4**

Principles of operation and equipment for thermal processing, Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapour recompression. Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freeze drying. (Practicals) Study of evaporators, Study of milk dryers, Study of freezers, Estimation of steam requirements.

• **Unit 5**

Filtration: principle, types of filters; Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications, Non-thermal and other alternate thermal processing in Food processing. (Practicals) Study of filtration, Design of food processing plants & preparation of layout

Suggested Readings

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

DAIRY ENGINEERING SPECIALIZATION (cont...)

AEM711-DAIRY ENGINEERING LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

- Study of pasteurizers,
- Study of sterilizers,
- Study of homogenizers,
- Study of separators,
- Study of butter churns,
- Study of evaporators,
- Study of milk dryers,
- Study of freezers,
- Study of filtration,
- Design of food processing plants & preparation of layout,
- Visit to multi-product dairy plant,
- Estimation of steam requirements,
- Estimation of refrigeration requirements in dairy & food plant.

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

AEM712-AGRICULTURE MARKETING TRADE & PRICES (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **UNIT 1**

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, Market segmentation, classification and characteristics of agricultural markets, Nature and determinants of demand and supply of farm products, Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agril.-commodities

• **UNIT 2**

Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC, Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing, Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits, Marketing process-concentration, dispersion and equalization

• **UNIT 3**

Marketing functions; Exchange functions – buying and selling Physical functions – storage, transport and processing, Facilitating functions – packaging, branding, grading, quality control and labeling (Agmark), Types and importance of agencies involved in agricultural marketing, Meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products,

• **UNIT 4**

Price spread: Meaning, definition and types of market integration, Marketing efficiency; marketing costs, margins and price spread, Factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs, Public sector institutions- CWC, SWC, FCI, CACP & DMI - their objectives and functions; cooperative marketing in India, Types of risk in marketing; speculation & hedging; an overview of futures trading

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION (cont...)

AEM712-AGRICULTURE MARKETING TRADE & PRICES (3.0) (cont...)

• UNIT 5

Meaning and functions of price; administered prices; need for agricultural price policy, Concept of International Trade and its need, theories of absolute and comparative advantage , Present status and prospects of international trade in agricommodities; GATT and WTO, Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR

SUGGESTED READINGS

- Agricultural Marketing in India by S.S. Acharya & N.L. Agarwal, Oxford & IBH Publising Co. Pvt. Ltd, New Delhi.
- Marketing Management: A South Asian Perspective by Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha, Dorling Kindersley (India) Pvt. Ltd. Licensees of Pearson Education in South Asia.
- Agricultural Economics by Subba Reddy, P. Raghu Ram, T.V. Neelkanta Sastry & I. Bhavani Devi, Second Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION (cont...)

AEM713-AI AND MACHINE LEARNING IN AGRICULTURE (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **UNIT 1**

Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.

• **UNIT 2**

Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.

• **UNIT 3**

Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

• **UNIT 4**

Introduction to machine learning, Types of learning, Need and Applications of machine learning, Machine learning Versus Artificial Intelligence, Challenges of machine learning, Basic Components of learning, Hypothesis space, Dimensionality Reduction: Introduction, Feature selection, Feature Extraction, Need of dimensionality reduction, Principal Component Analysis.

• **UNIT 5**

Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning.

SUGGESTED READINGS:

- Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill
- E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson Education

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION (cont...)

AEM714-MODERN AGRITECH LAB (1.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 1, Periods (55 mts. each)/week: 2(L:0+T:0+P:2+S:0), Min.pds./sem:26

- Carry out real-time data collection and processing through UAV
- Installs and troubleshoots the components of drones/UAV equipped with appropriate cameras, sensors (Optical Sensors etc.) and integrating modules for crop monitoring & spraying, soil & field analysis, plant counting and yield prediction, plant height measurement, canopy cover mapping and so on.
- Implementation of logic gates using McCulloch-Pitts model , Rosenblatt's perceptron models
- Hebs rule, Delta Rule, Effect of Different activation functions
- Implementation of Single Layer and Multi Layer Perceptron models
- Back propagation, Art-1, Art-2 Implementation
- Implementation of Fuzzy operations and relations , Fuzzy Controller , Genetic Algorithm
- Study of machine learning library in Keras.
- Write a python code to implement K-nearest neighbourhood program for the given dataset.
- Write a python code to implement decision tree for a given dataset.
- Write a python code to apply Naive Bayesian algorithm to classify a dataset from UCI/Kaggle.
- Write a program to implement perceptron. Test for OR Gate, AND Gate and XOR Gate.
- Implement Neural networks using Keras. Test to classify disease infested crop data into severe and moderate (use diseased crop data set) and obtain its accuracy level.
- Study of Linear Regression with Excel.
- Write a python code for prediction using linear regression model. Test with suitable dataset.
- Write a python program to build an email spam classifier using support vector machines for the Spam base dataset from UCI machine learning repository.
- Write a python program to perform clustering using python. Test with suitable dataset.
- Study of WEKA tool for Preprocessing and Visualization.
- Use WEKA tool for Classification and Clustering.

OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

AEM715- BIO ENERGY SYSTEMS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **UNIT 1**

Fermentation processes and its general requirements, An overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential.

• **UNIT 2**

Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. Harvesting of biomass and coppicing characteristics.

• **UNIT 3**

Biomass preparation techniques for harnessing (size reduction, densification and drying). Thermochemical degradation. History of small gas producer engine system. Chemistry of gasification.

• **UNIT 4**

Gas producer – type, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application, shaft power generation, thermal application and economics.

• **UNIT 5**

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

Suggested Readings

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

OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

(cont...)

AEM716- SEED PROCESSING TECHNOLOGY (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **UNIT 1**

Definition and characteristics of seed and how it differs from grain; Propagation of crop plants through true seed and vegetative means; Features of good quality seed; Importance of seed in successful crop production; Floral biology: self and cross pollination; Methods of genetic improvement of crop plants such as selection, hybridization, mutation and polyploidy; Seed legislations promulgated in India from 1996 to date and the purpose of each of these legislations.

• **UNIT 2**

Multiplication of seed and seed material: systems of seed multiplication, classes of seed, multiplication models, multiplication ratio, field selection, planting ratio, isolation needs and roughing; Harvest and extraction of seed; Methods of hybrid seed production; Genetic deterioration during crop production cycles; Seed certification process: legal basis, pre-requisites for applicability, detailed description of the specific steps of the certification process (with particular emphasis on field inspection).

• **UNIT 3**

Components of seed processing in a broader sense; Steps in seed processing in its narrower sense: preliminary cleaning, basic cleaning and grading, and equipment used in each of the steps; Seed treatment; Seed drying; Seed sampling; Seed testing: details of specific tests conducted for different purposes (service, certification and seed law enforcement); Standards prescribed for different crops.

• **UNIT 4**

Types of organizations involved in seed production (public, quasi-governmental, private and cooperative), and their objectives and features; Organizational set up of a seed company; Steps involved in planning and developing a seed programme; Seed marketing activities and analysis of seed demand and supply; Opportunities for Indian seed companies to have a greater share of world seed market; Visit to seed organizations; Preparing seed projects to obtain credit; Export procedures and formalities; Seed/plant quarantine method.

• **UNIT 5**

Principles and special techniques used for seed production in important horticultural crops by selecting representatives of vegetable / flower / fruit / spice / condiment / plantation crops.

SUGGESTED READINGS

- Singh, S.P., Commercial Vegetable Seed Production, Kalyani Publishers, Chennai, 2001
- Agarwal, R.L., Seed Technology, Oxford IBH Publishing.Co., New Delhi, 1995

OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

(cont...)

AEM717-DESIGN OF STRUCTURES (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

Loads and use of BIS Codes. Design of connections. Design and drawing of single reinforced beam, double reinforced beam.

- **Unit 2**

Design of structural steel members intension, compression and bending. Design and drawing of one way, two way slabs

- **Unit 3**

Design of steel roof truss. Design and drawing of steel roof truss

- **Unit 4**

Analysis and design of singly and doubly reinforced sections, Shear, Bond and Torsion. Design and drawing of RCC building;

- **Unit 5**

Design of Flanged Beams, Slabs, Columns, Foundations, Retaining walls and Silos. Design and drawing of Retaining wall. To measure workability of cement by slump test

Suggested Readings

- Junarkar, S.B. 2001. Mechanics of Structures Vol. I Charotar Publishing Home, Anand.
- Khurmi R. S. 2001. Strength of materials. S. Chand & Company Ltd., Ram Nagar, New Delhi
- Kumar Sushil 2003. Treasure of R.C.C. Design. R.K. Jain. 1705-A, Nai Sarak , Delhi-110006,

OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

(cont...)

AEM718-AGRICULTURAL DATA ANALYTICS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **UNIT 1**

Precision agriculture technologies, prescriptive agriculture services, public and private data

- **UNIT 2**

Agriculture gateway glossary:ISO 11783, shapefiles, KMZs, GeoTIFFs, CSV, TXT, yld etc, machinery and agronomic data

- **UNIT 3**

Structure and data elements within files, obtaining meaningful data layers, organizing and managing data using today's technologies (cloud etc.), data accuracy, precision, errors, cleaning

- **UNIT 4**

Data visualization, identifying outliers: using algorithms to scrub data, identifying research topics and appropriate analytical techniques

- **UNIT 5**

Spatial data analysis techniques-geostatistics, kriging

SUGGESTED READINGS

- Fischer, M.M., and A. Getis. 2010. Handbook of Applied Spatial Analysis; Software Tools, Methods and Applications. Springer-Verlag Berlin Heidelberg.
- Price, M.H. 2016. Mastering ArcGIS. McGraw Hill Education: New York, New York. 7th Ed. Crawley, M.J. 2013. The R Book. John Wiley and Sons, Ltd.: Chichester, West Sussex, United Kingdom. 2nd Ed.

OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

(cont...)

AEM719-FARM MACHINERY DESIGN AND PRODUCTION (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

Introduction to design parameters of Agricultural Machines and design procedure, Characteristics of farm Machinery Design, Research and Development Aspect of farm Machinery.

• **Unit 2**

Design of standard power transmission components used in Agricultural Machines, mechanical and hydraulic units, Design of bearings, Introduction to safety in power transmission, Application of design principles to the system of selected farm Machineries

• **Unit 3**

Critical Appraisal in Production of Agricultural Machines, Advances in materials used for Ag Machinery, Cutting tools including CNC tools and finished tools, Advance manufacturing techniques like powder metallurgy, EDM, carburising etc

• **Unit 4**

Limits, Fits and tolerances, Jigs and fixtures

• **Unit 5**

Layout Planning of a small scale industry, Quality production management, Problems on economics of Process Selection and reliability; Case study for manufacturing a simple Agriculture machinery

SUGGESTED READINGS

- Raymond N Y, EEzzat A F and Nicolas Skiadas.(1984), Vehicle Traction Mechanics, Elsevier Science Publishers B V, New York.
- Sharma, D N and Mukesh, S.(2010), Design of Agricultural Tractor- Principles and problems,Jain brothers, New Delhi.

OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

(cont...)

AEM720-HUMAN ENGINEERING AND SAFETY (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

Human factors in system development – concept of systems; basic processes in system development, performance reliability, human performance.

• **Unit 2**

Information input process, visual displays, major types and use of displays, auditory and factual displays. Speech communications.

• **Unit 3**

Biomechanics of motion, types of movements, Range of movements, strength and endurance, speed and accuracy, human control of systems.

• **Unit 4**

Human motor activities, controls, tools and related devices. Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution.

• **Unit 5**

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

Suggested Readings

- Chapanis A. 1996. Human Factors in System Engineering. John Wiley & Sons, New York.
- Dul J. and Weerdmeester B.1993. Ergonomics for Beginners. A Quick Reference Guide.Taylor and Francis, London.
- Mathews J. and Knight A. A. 1971. Ergonomics in Agricultural Equipment Design. NationalInstitute of Agricultural Engineering.

OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

(cont...)

MEM728-ADDITIVE MANUFACT. FOR 3D PRINTING (2.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2015-16

Total Credits:2, Periods (55 mts. each)/ week:2(L-2+T-0+P:0+S-0), Min.pds./sem.: 26

UNIT 1

History and Technology background. Design principles for Additive Manufacturing. Technology impact on society and novel applications.

UNIT 2

Solid-Based Processes- Fused Deposition Modelling (FDM) and Polyjet; Light-Based Processes- Polyjet; Powder-Based Processes-Selective Laser Sintering (SLS), Liquid-Based Processes- Stereolithography (SLA).

UNIT 3

Rate, dimensions, cost and flexibility. Control of mechanical, thermal, and other functional properties. Materials for AM & issues. Design rules for AM; Process and quality control in additive manufacturing: Accuracy, repeatability, Fabrication speed.

UNIT 4

AM Process Chain; Application Workflow; 3D modeling; STL Data Structure, Error and Repair; process planning, and measurement. CAD systems for additive manufacturing. 3D content creating: Scanning. Post processing for additive manufacturing.

UNIT 5

Applications, including examples from aerospace, biomedical, architecture, energy, consumer devices and others. Future trends and implications of additive manufacturing. Emerging materials.

SUGGESTED READINGS:

- Gebhardt: UNDERSTANDING ADDITIVE MANUFACTURING, Hanser.
- Lipson & Kurman: FABRICATED: THE NEW WORLD OF 3D PRINTING, Wiley.
- Gibson, Rosen, Stucker: ADDITIVE MANUFACTURING TECHNOLOGIES: RAPID PROTOTYPING TO DIRECT DIGITAL MANUFACTURING. Springer.

OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

(cont...)

MEM728-ADDITIVE MANUFACT. FOR 3D PRINTING LAB (1.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2015-16

Total Credits:1, Periods (55 mts. each)/ week:2(L-0+T-0+P:2+S-0), Min.pds./sem.: 26

- Anatomy of 3d Printer
- Assembly of 3D Printer
- Fused deposition Modeling (FDM)
- Polyjet Modeling
- 3D Scanning exercise
- Design and printing exercise

OPTIONAL COURSES-DAIRY ENGINEERING SPECIALIZATION

AEM721-NUTRITIONAL MANAGEMENT IN DAIRY FARM (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **UNIT 1**

The essentials in the proper feeding of Dairy cattle, Energy requirements for maintenance and Production

- **UNIT 2**

Digestive system of cattle Dairy Cattle

- **UNIT 3**

Nutritional Requirements of Dairy Cattle (young calves, Calves, Heifers, Pregnant heifers, lactating cattle, Dried cattle)

- **UNIT 4**

Forages - Brief description of fodder crops. Grains - Proteins - Lipids - Minerals and vitamins – Water

- **UNIT 5**

Total Mix Ration system, Component-fed Rations, Pasture-based Feeding Systems, Characteristics of a good Dairy ration, Economic Supply of nutrients

SUGGESTED READINGS:

- I C A R Hand book of Animal Husbandry
- Mahendra Singh and Jancy Gupta Buffalo Dairy Husbandry Practices NDRI Karnal
- Anjali Agrawal and R.C.Upadhyay Important Micronutrients and Supplementation in Transition Dairy Cows NDRI Karnal

AEM720-HUMAN ENGINEERING AND SAFETY (3.0) (Common)

MEM728,729-ADDITIVE MANUFACT. FOR 3D PRINTING , LAB (3.0) (Common)

OPTIONAL COURSES-AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

AEM718-AGRICULTURAL DATA ANALYTICS (3.0) (Common to Mainstream AE)

AEM720-HUMAN ENGINEERING AND SAFETY (3.0) (Common)

AEM722-UAV IN AGRICULTURE (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **UNIT 1**

Overview of Remote sensing and UAV, Types of UAV: fixed vane and quad-copter, Sensor used in UAV

• **UNIT 2**

Usage of UAV in agriculture for crop health assessment, irrigation, nutrient management, crop monitoring, crop spraying, planting and soil & field analysis, drainage mapping , use of thermal camera in smart farming.

• **UNIT 3**

GIS techniques to extract geospatial data from UAV, Data Pre-processing, Video Image Processing, Image processing and color indices calculation, Data processing methods

• **UNIT 4**

Safe operation of UAVs in manual and programmed flight mode, legal regulations on use of UAVs, Current and futures issues of drones

• **UNIT 5**

Case studies related to application of UAV in agriculture

SUGGESTED READING

- Warner, E. S., Graham, R. W., Read, R. E., 1996. Small format AERIAL PHOTOGRAPHY. Whittles Publishing. Malta
- Krishna, K. R., 2021, Agricultural drones: a peaceful pursuit, Apple academic press

OPTIONAL COURSES-AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

(cont...)

AEM723-SENSORS AND MICRO CONTROLLERS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **UNIT 1**

Review: Active passive components. Discrete components circuits, Semiconductors, Semiconductor diodes: characteristics, diode equation, rectifier and other application, Zener diodes, Breakdown mechanisms, use as a voltage regulator, regulated power supply. Transistors: pnp, npn transistors and their characteristics, current relationships, applications as an amplifier.

- **UNIT 2**

Operational Amplifiers: Ideal operational amplifier characteristics, concept of feedback, open/closed loop gain, inverting, non-inverting amplifier, Zero crossing detector, Applications: summer, integrator, differentiator and other mathematical operations, active filters.

- **UNIT 3**

Terminology, Sensor types and selection, motion sensor, infrared (IR) sensors, microphones, cameras, GPS, accelerometers, ultrasonic sensor, torque sensors, gyroscope sensors, optical sensors, tactile sensors, MEMS sensors

- **UNIT 4:**

Microcontroller and their working, elements and features of microcontroller, types of microcontroller, Application of microcontroller

OPTIONAL COURSES-AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

(cont...)

AEM723-SENSORS AND MICRO CONTROLLERS (3.0) (cont...)

• **UNIT 5**

Instrumentation process steps and real-world applications, control system architecture – feed forward and feedback. Data Acquisition Hardware, Digital-to-Analog Converter, DAC Operation, Analog-to-Digital Converter- Successive Approximation ADC, Delta–Sigma ADC, ADC Performance Characteristics.

SUGGESTED READINGS:

- Malvino,A.P. and Leach,D., :DIGITAL PRINCIPLES AND APPLICATIONS
- Jain RP: MODERN DIGITAL THEORY
- Boylestadt&Nashelsky :ELECTRONIC DEVICES AND CIRCUIT THEORY

MEM728,729-ADDITIVE MANUFACT. FOR 3D PRINTING , LAB (3.0) (Common)

EIGHTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM801	AGRICULTURAL ENGINEERING PROJECT II	8.0	Y	P
AEM802	AGRICULTURE EXTENSION	2.0	N	T
AEM803	AGRICULTURE EXTENSION PRACTICE	1.0	Y	P
AEM804	MINOR PROJECT-II	1.0	Y	P
CAC881	CO-CURRICULAR ACTIVITIES	3.0	N	P
#	STREAM WISE CORE COURSES	3.0	Y	T
*	STREAM WISE FIRST OPTIONAL COURSES	3.0	Y	T
**	STREAM WISE SECOND OPTIONAL COURSES	3.0	Y	T
***	STREAM WISE THIRD OPTIONAL COURSES	3.0	Y	T
TOTAL CREDITS		27.0		

Stream-wise CORE Courses (#):

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM805	TRACTOR SYSTEMS AND CONTROLS	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM806	FOOD PLANT DESIGN AND MANAGEMENT	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM807	CONSUMER BEHAVIOUR & ANALYSIS	3.0	Y	T

EIGHTH SEMESTER (cont...)

STREAM-WISE FIRST OPTIONAL COURSES (*) - any one of the following to be opted

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM808	PRECISION FARMING TECHNIQUES FOR FIELD AND PROTECTED CROP PRODUCTION	3.0	Y	T
AEM809	POSTHARVEST ENGINEERING OF HORTICULTURE CROPS	3.0	Y	T
AEM810	PLASTIC APPLICATION IN AGRICULTURE	3.0	Y	T
AEM811	MECHATRONICS	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM812	DEVELOPMENT OF PROCESSED PRODUCTS	3.0	Y	T
AEM810	PLASTIC APPLICATION IN AGRICULTURE	3.0	Y	T
AEM811	MECHATRONICS	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM813	INTELLETUAL PROPERTY RIGHT	3.0	Y	T
AEM814	PREDICTIVE ANALYTICS IN AGRICULTURE	3.0	Y	T

EIGHTH SEMESTER (cont...)

STREAM-WISE SECOND OPTIONAL COURSES ()** - any one of the following to be opted

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM815	WASTELAND DEVELOPMENT	3.0	Y	T
AEM816	HYDRAULIC DRIVES AND CONTROLS	3.0	Y	T
AEM817	WASTE AND BYPRODUCT UTILIZATION	3.0	Y	T
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
AEM819	SPRINKLER AND MICRO IRRIGATION SYSTEM	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM820	PROCESS EQUIPMENT DESIGN	3.0	Y	T
AEM821	PACKAGING TECHNOLOGY	3.0	Y	T
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
MEM824	TOTAL QUALITY MANAGEMENT	3.0	Y	T

EIGHTH SEMESTER (cont...)

STREAM-WISE THIRD OPTIONAL COURSES (*) - any one of the following to be opted**

AEM822	PRECISION AGRICULTURE AND SYSTEM MANAGEMENT	3.0	Y	T
AEM823	PHOTOVOLTAIC TECHNOLOGY AND SYSTEMS	3.0	Y	T
EEM811	ROBOTICS	3.0	Y	T
MEM809	NANO-TECHNOLOGY & NANO-COMPUTING	3.0	Y	T
MEM811	FUTURES STUDIES	3.0	Y	T
MEM814	MANAGEMENT INFORMATION SYSTEMS	3.0	Y	T
MEM827	OPERATIONS MANAGEMENT	3.0	Y	T

AEM 801-AGRICULTURAL ENGINEERING PROJECT II (8.0)

Class: B.Tech., Status of Course: MAJOR COURSE,, Approved since session:

Total Credits:3, Periods (55 mts. Each)/week:4(L:0+T:0+P:6+S:0), Min.pds./sem.: 52

In this project the students continue their work of Course No. AEM701. The project involves Design and development of Hardware and Software for a system of complexity level normally covered in the theory upto 8th semester in B.Tech.

AEM802-AGRICULTURE EXTENSION (2.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

• **UNIT 1** Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

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

• **UNIT 2**

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

• **UNIT 3**

Modern communication sources – internet, video and teleconferencing, interactive multimedia, compact disc (IMCD), Village kiosks, kisan call centre (kcc), mobile phone

• **UNIT 4**

Diffusion – meaning and elements. Adoption – meaning – adoptor categories influencing adoption, stages of adoption, innovation decision process and attribution of innovations consequences of adoption

• **UNIT 5**

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

SUGGESTED READINGS:

- Ray, G.L., 1999. Extension communication and mangement, Naya Prakash, Vidhan Sarani, Kolkata
- Sandhu, A.S., 1996. Extension Programme Planning, Oxford and IBH PublishingCO. (P) Ltd., New Delhi

AEM803-AGRICULTURE EXTENSION PRACTICE (1.0)

Class: B.Tech., Status of Course: Half Major Course, Approved since session:

Total Credits:1, Periods(55 mts. each)/week:2(L:0+T:0+P:2+S:0), Min.pds./sem.:26

Students will practice or exercise the agriculture extension by working in village medical camps, spreading awareness to farmers about the use of technology in agriculture.

AEM804-MINOR PROJECT-II (1.0)

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01

Total Credits: 1, Periods (55 mts. each)/week: 2 (L:0+T:0+P:2+S:0), Min.pds./sem.: 26

1. Exposure to agritech startups, listing the startups and case studies
2. To increase the farm productivity that will increase the farms income
3. Make innovative farm equipments for small and medium farmer
4. To develop cost effective storage system for vegetables and fruits at small scale
5. Visit to IARI/ICAR/some reputed agricultural facilities

CAC881-CO-CURRICULAR ACTIVITIES (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2000-01

Total Credits: 3, Periods (55 mts. each)/week: 3 for 26 weeks, Min.pds./sem: 52

Participation by the students in sports and games, literary, social, cultural and professional activities is compulsory. The proficiency attained in them is evaluated every year and counted in the assessment of the overall performance of the student to encourage a balanced and all-round development of their personality.

MAINSTREAM AGRICULTURAL ENGINEERING

AEM805-TRACTOR SYSTEMS AND CONTROLS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

- **Unit 1**

Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems.

- **Unit 2**

Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio. Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive. Study of Brake system – types, principle of operation, construction, calculation for braking torque.

- **Unit 3**

Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors. Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments and ADDC.

- **Unit 4**

Study of tractor power outlets – PTO. PTO standards, types and functional requirements. Introduction to traction. Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study of wheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids.

- **Unit 5**

Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes.

Suggested Readings

- Liljedahl J B and Others. Tractors and Their Power Units.
- Rodichev V and G Rodicheva. Tractors and Automobiles.

DAIRY ENGINEERING SPECIALIZATION

AEM806-FOOD PLANT DESIGN AND MANAGEMENT (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

Food plant location, selection criteria, Selection of processes, plant capacity, Requirements of plant building and its components, Project design, flow diagrams, selection of equipment, process and controls, Objectives and principles of food plant layout. Preparation of project report and feasibility report.

- **Unit 2**

Salient features of processing plants for cereals, pulses, oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products. Salient features and layout of pre processing house, Salient features and layout of Milk and Milk product plants, Salient features, design and layout of modern rice mill, Salient features, design and layout of Bakery and related product plant

- **Unit 3**

Introduction to Finance, Food Product Marketing, Food Business Analysis and Strategic Planning, Introduction to Marketing, Food Marketing Management, Supply chain management for retail food products, Study of different types of records relating to finance of a food plant

- **Unit 4**

Entrepreneurship development in food industry, SWOT analysis, generation, incubation and commercialization of ideas and innovations, New product development process, Government schemes and incentive for promotion of entrepreneurship, Brain storming and SWOT analysis to start a food processing business.

- **Unit 5**

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

Suggested Readings

- Hall, H.S. and Rosen, Y.S. Milk Plant Layout. FAO Publication, Rome.

- López Antonio, Gómez Food Plant Design

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

AEM807-CONSUMER BEHAVIOUR & ANALYSIS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **UNIT 1**

Introduction and concept:-Introduction market strategy and consumer behaviour, Market Analysis, consumer decision process, Culture and consumer behaviour: - Meaning of culture, Characteristics of culture, function of culture. types of culture, Cross-cultural consumer analysis:- cross cultural marketing objectives, Basic areas for cross-cultural marketing, problem in cross cultural marketing.

- **UNIT 2**

Motivation and consumer behaviour: - Introduction, motives and motivation, positive or negative motivation, Consumer motives:- personal ,social motives, Involvement:-types of involvement, measuring involvement, values , values and attitudes, means and end chain model

- **UNIT 3**

Introduction, of groups , advantages and disadvantage of groups, reference group, types of reference group, social class and consumer behavior- Introduction social class categorization, social class life style and buying behavior, social class and market segmentation, social factors, social class and consumer behavior

- **UNIT 4**

Perception and consumer behaviour: - Introduction, meaning, nature, Importance and limitation of perception, Barriers to accurate perception, Sensation, perception of values, perception of process. Determining consumer buying Behaviour:-Consumer purchase decision, types of decision, types of decision behaviour, buying stage and situational influence, models of consumer behaviour, Economic model, learning model, sociological model, Howard Sheth model of buying.

AGRITECH&ENTREPRENEURSHIP SPECIALIZATION (cont...)

AEM807-CONSUMER BEHAVIOUR & ANALYSIS (3.0) (cont...)

• UNIT 5

Attitude and consumer behaviour:- Meaning of attitude, nature and characteristics of attitude, types of attitude, learning of attitude, sources of influence on attitude formation, Model of attitude- Tricomponent attitude model, multi attribute attitude model, Consumer decision making process:- Introduction, levels of consumer decision ,consumer information processing model ,Hierarchy of effects model.

SUGGESTED READINGS:

- Andrew Smith, Consumer behaviour and analytics, Routledge publication
- Leon Schiffman, Consumer behaviour, Pearson publication

STREAMWISE FIRST OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING

AEM808-PRECISION FARMING TECHNIQUES FOR FIELD AND PROTECTED CROP PRODUCTION

(3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

Protected cultivation: Introduction, History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polyhouses / shade nets, Cladding materials, Plant environment interactions – principles of limiting factors

▪ **Unit 2**

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,

• **Unit 3**

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.

• **Unit 4**

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.

• **Unit 5**

Greenhouse climate measurement, control and management. Insect and disease management in greenhouse and net houses Selection of crops for greenhouse cultivation, major crops in greenhouse – irrigation requirement, fertilizer management, cultivation, harvesting and post harvest techniques; Economic analysis.

Suggested Readings

- Singh Brahma and Balraj Singh. 2014. Advances in protected cultivation, New India Publishing Company.
- Sharma P. 2007. Precision Farming. Daya Publishing House New Delhi.

STREAMWISE FIRST OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM809-POSTHARVEST ENGINEERING OF HORTICULTURAL CROPS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit 1

Importance of processing of fruits and vegetables, spices, condiments and flowers. Characteristics and properties of horticultural crops important for processing, Peeling: Different peeling methods and devices (manual peeling, mechanical peeling, chemical peeling, and thermal peeling), Slicing of horticultural crops: equipment for slicing, shredding, crushing, chopping, juice extraction, etc.

Unit 2

Blanching: Importance and objectives; blanching methods, effects on food (nutrition, colour, pigment, texture); Chilling and freezing: Application of refrigeration in different perishable food products, Thermophilic, mesophilic & Psychrophilic micro-organisms, Chilling requirements of different fruits and vegetables, Freezing of food, freezing time calculations, slow and fast freezing, Equipment for chilling and freezing (mechanical & cryogenic).

Unit 3

Effect on food during chilling and freezing, Cold storage heat load calculations and cold storage design, refrigerated vehicle and cold chain system, Dryers for fruits and vegetables, Osmo-dehydration. Packaging of horticultural commodities, Packaging requirements (in terms of light transmittance, heat, moisture and gas proof, micro organisms, mechanical strength), Different types of packaging materials commonly used for raw and processed fruits and vegetables products.

Unit 4

Bulk and retail packages and packaging machines, handling and transportation of fruits and vegetables, Pack house technology, Controlled atmospheric storage, Modified atmospheric packaging, Preservation Technology, General methods of preservation of fruits and vegetables, Brief description and advantages and disadvantages of different physical/ chemical and other methods of preservation.

STREAMWISE FIRST OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM809-POSTHARVEST ENGINEERING OF HORTICULTURAL CROPS (3.0) (cont...)

• **Unit 5**

Minimal processing, Common methods of storage, Low temperature storage, evaporative cooled storage, Flowcharts for preparation of different finished products, Important parameters and equipment used for different unit operations, Post harvest management and equipment for spices and flowers, Quality control in Fruit and vegetable processing industry. Food supply chain.

Suggested Readings

- Pantastico, E.C.B. 1975. Postharvest physiology, handling and utilization of tropical and subtropical fruits and vegetables, AVI Pub. Co., New Delhi.
- Pandey R.H. 1997. Postharvest Technology of fruits and vegetables (Principles and practices). Saroj Prakashan, Allahabad.
- Sudheer K P. and IndiraV. 2007. Post Harvest Engineering of horticultural crops. New india Publishing House.

STREAMWISE FIRST OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM810-PLASTIC APPLICATIONS IN AGRICULTURE (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

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

- **Unit 2**

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

- **Unit 3**

Nursery management - Use of plastics in nursery raising, nursery bags, trays etc. Controlled environmental cultivation - plastics as cladding material, green / poly / shade net houses, wind breaks, poly tunnels and crop covers. Plastic nets for crop protection - anti insect nets, bird protection nets.

- **Unit 4**

Plastic fencing. Plastics in drying, preservation, handling and storage of agricultural produce, innovative plastic packaging solutions for processed food products. Plastic cap covers for storage of food grains in open. Use of plastics as alternate material for manufacturing farm equipment and machinery.

- **Unit 5**

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

Suggested Readings:

- Brahma Singh, Balraj Singh, Naved Sabir and Murtaza Hasan. 2014. Advances in Protected Cultivation. New India Publishing Agency, New Delhi.
- Brown, R.P. 2004. Polymers in Agriculture and Horticulture. RAPRA Review Reports : Vol. 15, No. 2, RAPRA Technology Limited, U.K.

STREAMWISE FIRST OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM811-MECHATRONICS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

Definition of mechatronics, measurement system, control systems, microprocessor based controllers, mechatronics approach. Sensors and transducers, performance terminology, Displacement, Position & Proximity Sensors, photo-electric transducers, flow transducers, optical sensors and transducers.

• **Unit 2**

Actuators, Mechanical Actuation Systems, Hydraulic & Pneumatic Actuation Systems, Electrical Actuation Systems, A.C. Motor, D.C. Motor, Stepper Motor. Signal conditioning process, filtering digital signal, multiplexers, data acquisition, digital signal processing, measurement system, pulse modulation, data presentation systems.

• **Unit 3**

System modelling & control, Mathematical Models, Engineering Systems, Electro-mechanical & Hydraulic-mechanical Systems, Modelling Dynamic Systems, Transfer Functions, Control Modes, PID Controller.

• **Unit 4**

Micro-processor & computer, Computer and Interfacing, Micro-computer Structure, Micro-controllers, Application of Microcontrollers, PLC. Robotics, Robot components, robot classification and specification, Work envelopes, other basic parameters of robots.

• **Unit 5**

Robot applications, Robot applications in manufacturing, Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Future applications.

Suggested Readings

- Bolton, W. Mechatronics. Pearson Education Asia.
- Wolfram, Stadler. Analytical Robotics and Mechatronics. Mc-Graw Hill.

STREAMWISE FIRST OPTIONAL COURSES-DAIRY ENGINEERING SPECIALIZATION

AEM812-DEVELOPMENT OF PROCESSED PRODUCTS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

Process design, Process flow chart with mass and energy balance, Unit operations and equipment for processing, New product development,

• **Unit 2**

Technology for value added products from cereal, pulses and oil seeds, Milling, puffing, flaking, Roasting, Bakery products, snack food.

• **Unit 3**

Extruded products, oil extraction and refining, Technology for value added products from fruits, vegetables and spices,

• **Unit 4**

Canned foods, Frozen foods, dried and fried foods, Fruit juices, Sauce, Sugar based confection, Candy, Fermented food product, spice extracts,

• **Unit 5**

Technology for animal produce processing , meat, poultry, fish, egg products, Health food, Nutra-ceuticals and functional food, Organic food. Visit to roller wheat flour milling

Suggested Readings

- Geankoplis C. J. Transport processes and unit operations, Prentice-Hall.
- Rao, D. G. Fundamentals of Food Engineering PHI Learning Pvt. Ltd, New Delhi.
- Norman N. Potter and Joseph H. Hotchikss. Food Science. Chapman and Hall Pub.

AEM810-PLASTIC APPLICATIONS IN AGRICULTURE (3.0)

AEM811-MECHATRONICS (3.0)

(Common to mainstream AE)

STREAMWISE FIRST OPTIONAL COURSES- AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

AEM813-INTELLECTUAL PROPERTY RIGHT (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 39

• UNIT 1

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967, the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

• UNIT 2

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

• UNIT 3

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

• UNIT 4

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

• UNIT 5

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection, Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection, Plant variety protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection, Layout Design protection: meaning – Procedure for registration, effect of registration and term of protection

SUGGESTED READING

- Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

STREAMWISE FIRST OPTIONAL COURSES- AGRITECH&ENTREPRENEURSHIP SPECIALIZATION (cont...)

AEM814-PREDICTIVE ANALYTICS IN AGRICULTURE (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **UNIT 1**

Introduction to Regression Model, model development & Validation, multiple linear regression, estimation of regression parameters, model diagnostics, dummy, derived & interaction variables, multi-collinearity, model deployment

- **UNIT 2**

Discrete choice models, logistics regression, estimation of parameters, logistic model interpretation, logistic model diagnostics, deployment

- **UNIT 3**

Introduction to decision trees, chi-square automatic interaction detectors, classification and regression tree (CART), Analysis of unstructured data, naïve bayes algorithm,

- **UNIT 4**

Forecasting, time series analysis, additive and multiplicative models, exponential smoothing techniques, forecasting accuracy, auto-regressive and moving average models

- **UNIT 5**

Application of predictive analytics techniques in agriculture: case studies

SUGGESTED READING

- Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009.

STREAMWISE SECOND OPTIONAL COURSES-MAINSTREAM

AGRICULTURAL ENGINEERING

AEM815-WASTELAND DEVELOPMENT (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

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

- **Unit 2**

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

- **Unit 3**

Shifting cultivation, optimal land use options. Waste land development – hills, semi-arid, coastal areas, water scarce areas, reclamation of waterlogged and salt-affected lands.

- **Unit 4**

Mine spoils- impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management. Micro-irrigation in wastelands development.

- **Unit 5**

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

Suggested Readings

- Abrol, IP, and V.V., Dhruvanarayana. 1998. Technologies for Wasteland Development. ICAR, New Delhi.
- Ambast, S.K., S.K. Gupta and Gurcharan Singh (Eds.) 2007. Agricultural Land Drainage -Reclamation of Waterlogged Saline Lands. Central Soil Salinity Research Institute, Karnal,Haryana.

STREAMWISE SECOND OPTIONAL COURSES-MAINSTREAM

AGRICULTURAL ENGINEERING (cont...)

AEM816-HYDRAULIC DRIVES AND CONTROLS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

Hydraulics Basics: Pascal's Law, Flow, Energy, Work, and Power. Hydraulic Systems, Colour Coding, Reservoirs, Strainers and Filters, Filtering Material and Elements. Accumulators, Pressure Gauges and Volume Meters, Hydraulic Circuit, Fittings and Connectors.

• **Unit 2**

Pumps, Pump Classifications, operation, performance, Displacement, Design of Gear Pumps, Vane Pumps, Piston Pumps. Hydraulic Actuators, Cylinders, Construction and Applications, Maintenance, Hydraulic Motors.

• **Unit 3**

Valves, Pressure-Control Valves, Directional- Control Valves, Flow-Control Valves, Valve. Installation, Valve Failures and Remedies, Valve Assembly, Troubleshooting of Valves Hydraulic Circuit Diagrams and Troubleshooting,

• **Unit 4**

United States of American Standards Institute USASI Graphical Symbols Tractor hydraulics, nudging system, ADDC. Pneumatics: Air services, logic units, Fail safe and safety systems

• **Unit 5**

Robotics: Application of Hydraulics and Pneumatics drives in agricultural systems, Programmable Logic Controls (PLCs). Use of hydraulics and pneumatics for robotics.

Suggested Readings

- Kepner RA, Roy Barger & EL Barger. Principles of Farm Machinery.
- Anthony E. Fluid Power and Applications.
- Majumdar. Oil Hydraulic System.

STREAMWISE SECOND OPTIONAL COURSES-MAINSTREAM

AGRICULTURAL ENGINEERING (cont...)

AEM817-WASTE AND BYPRODUCT UTILIZATION (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **UNIT 1**

Types and formation of by-products and waste; Magnitude of waste generation in different food processing industries; Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill etc., Visit to various industries using waste and food by-products.

• **UNIT 2**

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,

• **UNIT 3**

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 vermin-composting,

• **UNIT 4**

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.

STREAMWISE SECOND OPTIONAL COURSES-MAINSTREAM AGRICULTURAL ENGINEERING (cont...)

AEM817-WASTE AND BYPRODUCT UTILIZATION (3.0) (cont...)

• UNIT 5

Tertiary treatments: Advanced wastewater 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, Effluent treatment plants, Environmental performance of food industry to comply with ISO-14001 standards.

Suggested Readings

- Markel, I.A. 1981. Managing Livestock Waste, AVI Publishing Co.
- Pantastico, ECB. 1975. Post Harvest Physiology, Handling and utilization of Tropical and Sub-tropical fruits and vegetables, AVI Pub. Co.

**STREAMWISE SECOND OPTIONAL COURSES-MAINSTREAM
AGRICULTURAL ENGINEERING (cont...)
AEM818-SOFT COMPUTING IN AGRICULTURE SYSTEMS (3.0)**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

Definition, classification, and characteristics of systems- Scope and steps in systems engineering-Need for systems approach to water resources and irrigation.

• **Unit 2**

Introduction to Operations Research-Linear programming, problem formulation, graphical solution, solution by simplex method-sensitivity analysis-application-Bellman's optimality criteria, problem formulation and solutions-application.

• **Unit 3**

Basic principles and concepts-random variance and random process-Monte Carlo techniques-Model development-inputs and outputs-Deterministic and stochastic simulation-irrigation scheduling and application.

• **Unit 4**

Neuron, Nerve structure and synapse, Artificial Neuron and its model, Neural network architecture: networks, Various learning techniques; perception and convergence rule, Auto associative and hetro-associative memory-Architecture: model, solution, single layer and multilayer perception model, back propagation learning methods, applications.

• **Unit 5**

Basic concepts of fuzzy logic, Fuzzy set theory and operations, properties of fuzzy sets, membership functions, interface in fuzzy logic, fuzzy implications and fuzzy algorithms, fuzzy controller, industrial applications. Genetic algorithm (GA) – basic concepts, working principles, procedures, flow chart, genetic representations, encoding, initialization and selection, genetic operators, mutation-applications.

Suggested Readings

- Vedula, S., and Majumdar, P.P. Water resource systems – Modelling Techniques and Analysis, Tata Mc Graw Hill New Delhi

**STREAMWISE SECOND OPTIONAL COURSES-MAINSTREAM
AGRICULTURAL ENGINEERING (cont...)
AEM819-SPRINKLER AND MICRO IRRIGATION SYSTEM (3.0)**

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

• **Unit 1**

Sprinkler irrigation: adaptability, problems and prospects, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps; cost economics of sprinkler irrigation system

• **Unit 2**

Selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency; Micro Irrigation Systems: types-drip, spray, & bubbler systems, merits and demerits, different components;

• **Unit 3**

Design of drip irrigation system: general considerations, wetting patterns, irrigation requirement, emitter selection, hydraulics of drip irrigation system, design steps;

• **Unit 4**

Necessary steps for proper operation of a drip irrigation system; maintenance of micro irrigation system: clogging problems, filter cleaning, flushing and chemical treatment; cost economics of drip irrigation system

• **Unit 5**

Fertigation: advantages and limitations of fertigation, fertilizers solubility and their compatibility, precautions for successful fertigation system, fertigation frequency, duration and injection rate, methods of fertigation.

Suggested Readings

- Keller Jack and Bliesner Ron D. 2001. Sprinkle and Trickle Irrigation. Springer Science+ business Media, New York
- Mane M.S. and Ayare B.L.2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.

STREAMWISE SECOND OPTIONAL-DAIRY ENGINEERING SPECIALIZATION

AEM820-PROCESS EQUIPMENT DESIGN (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 5

• **Unit 1**

Introduction on process equipment design, Application of design engineering for processing equipments,

• **Unit 2**

Design parameters and general design procedure, Material specification, Types of material for process equipments, Design codes, Pressure vessel design, Design of cleaners.

• **Unit 3**

Design of tubular heat exchanger, shell and tube heat exchanger and plate heat exchanger,

• **Unit 4**

Design of belt conveyer, screw conveyer and bucket elevator, Design of dryers.

• **Unit 5**

Design of milling equipments. Optimization of design with respect to process efficiency, energy and cost, Computer Aided Design.

Suggested Readings

- Mahajani, V. V. and Umarji, S. B., Process equipment design, Macmillan.
- Bhattacharyya, B. C., Introduction to Chemical Equipment design, CBS Publishers and Distributors.
- Geankoplis C. J. Transport processes and unit operations, Prentice-Hall.

STREAMWISE SECOND OPTIONAL-DAIRY ENGINEERING SPECIALIZATION

(cont...)

AEM821-PACKAGING TECHNOLOGY (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **UNIT 1**

Factors affecting shelf life of food material during storage, Interactions of spoilage agents with environmental factors as water, oxygen, light, pH, etc. and general principles of control of the spoilage agents; Difference between food infection, food intoxication and allergy. Packaging of foods, requirement, importance and scope, frame work of packaging strategy, environmental considerations,

- **UNIT 2**

Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging; special solutions and packaging machines, technical packaging systems and data management packaging systems, Different types of packaging materials, their key properties and applications, Metal cans, manufacture of two piece and three piece cans, Plastic packaging, different types of polymers used in food packaging and their barrier properties.

- **UNIT 3**

Manufacture of plastic packaging materials, profile extrusion, blown film/ sheet extrusion, blow molding, extrusion blow molding, injection blow molding, stretch blow molding, injection molding. Glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, paper and paper board manufacture process, modification of barrier properties and characteristics of paper/ boards.

STREAMWISE SECOND OPTIONAL-DAIRY ENGINEERING SPECIALIZATION

(cont...)

AEM821-PACKAGING TECHNOLOGY (3.0) (cont...)

• **UNIT 4**

Relative advantages and disadvantages of different packaging materials; effect of these materials on packed commodities. Nutritional labelling on packages, CAS and MAP, shrink and cling packaging, vacuum and gas packaging; Active packaging, Smart packaging, Packaging requirement for raw and processed foods, and their selection of packaging materials, Factors affecting the choice of packaging materials, Disposal and recycle of packaging waste, Printing and labelling, Lamination,

• **UNIT 5**

Package testing: Testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper (thickness, bursting strength, breaking length, stiffness, tear resistance, folding endurance, ply bond test, surface oil absorption test, etc.), plastic film and laminates (thickness, tensile strength, gloss, haze, burning test to identify polymer, etc.), aluminium foil (thickness, pin holes, etc.), glass containers (visual defects, colour, dimensions, impact strength, etc.), metal containers (pressure test, product compatibility, etc.).

Suggested Readings

- Coles, R., McDowell, D., Kirwan, M .J. 2003. Food Packaging Technology. Blackwell Publishing Co.
- Gosby, N.T. 2001. Food Packaging Materials. Applied Science Publication
- John, P.J. 2008. A Handbook on Food Packaging Narendra Publishing House,

AEM818-SOFT COMPUTING IN AGRICULTURAL SYSTEMS (3.0) (Common)

STREAMWISE SECOND OPTIONAL-AGRITECH&ENTREPRENEURSHIP SPECIALIZATION

AEM818-SOFT COMPUTING IN AGRICULTURAL SYSTEMS (3.0) (Common)

MEM824-TOTAL QUALITY MANAGEMENT (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2011-12

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 52

• **UNIT 1**

Definition, historical review, basic concept of TQM, TQM framework, Principles of TQM, Leadership Role and Commitment in TQM, Strategic Quality Management, W.E. Deming's Philosophy, TQM Models, Barriers to TQM, Benefits of TQM.

• **UNIT 2**

Customer Perception of Quality, Types of Customer, Employee Involvement, Input/ Output Process Model, Juran Trilogy, Improvement Strategies, PDSA Cycle, 5-S System, Kaizen, Six Sigma.

• **UNIT 3**

Benchmarking concepts, Reason to Benchmark. Approaches to Benchmarking, Pitfalls of Benchmarking, Quality Function Deployment (QFD), QFD Matrix, Benefits of QFD, FMEA (Failure Mode Effect Analysis), Reliability, Failure Rate, FMEA Documentation, Total Productive Maintenance.

• **UNIT 4**

ISO, ISO 9000 Series of Standards, ISO 9001 requirements, Implementation, Documentation, ISO 14001, Implementation, Documentation.

• **UNIT 5**

Loss functions, Orthogonal Arrays, Signal to Noise Ratio, Parametric Design, Tolerance Design, Advantages/ Disadvantages of Taguchi's ideas.

SUGGESTED READING:

- TOTAL QUALITY MANAGEMENT: DH Besterfield, C Besterfield-Michna, GH Besterfield, M Besterfield-Scare, Pearson Education, Prentice Hall
- TOTAL QUALITY MANAGEMENT: W William. Dearborn

STREAMWISE THIRD OPTIONAL COURSES

AEM822-PRECISION AGRICULTURE AND SYSTEM MANAGEMENT (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

Precision Agriculture – need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with various machines for resource conservation

- **Unit 2**

Familiarization with equipment for precision agriculture including sowing and planting machines, power sprayers, land clearing machines, laser guided land levellers, straw-chopper, straw-balers, grain combines, etc., optimization of fertilizer application rate for cereals and horticulture crop, increase nutrient use efficiency

- **Unit 3**

Introduction to GIS based precision agriculture and its applications. Introduction to sensors and application of sensors for data generation. Problems related to cost analysis and inflation and problems related to selection of equipment, replacement,

- **Unit 4**

Database management. System concept. System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations. Solving problems related to various capacities, pattern efficiency, system limitation

- **Unit 5**

Application to PERT and CPM for machinery system management, break-even analysis, time value of money

Suggested Readings

- Kuhar J E. The Precision Farming Guide for Agriculturist.
- Dutta SK. Soil Conservation and land management.

STREAMWISE THIRD OPTIONAL COURSES (cont...)

AEM823-PHOTOVOLTAIC TECHNOLOGY AND SYSTEMS (3.0)

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

- **Unit 1**

Solar PV Technology: Advantages, Limitations, Current Status of PV technology, SWOT analysis of PV technology. Types of Solar Cell, Wafer based Silicon Cell, Thin film amorphous silicon cell Thin Cadmium Telluride (CdTe) Cell, Copper Indium Gallium Selenide (CiGS) Cell, Thin film crystalline silicon solar cell.

- **Unit 2**

Solar Photo Voltaic Module: Solar cell, solar module, solar array, series & parallel connections of cell, mismatch in cell, fill factor, effect of solar radiation and temperature on power output of module, I-V and power curve of module. V-I characteristics of solar PV system

- **Unit 3**

Balance of Solar PV system: Introduction to batteries, battery classification, lead acid battery, Nicked Cadmium battery, comparison of batteries, battery parameters,

- **Unit 4**

Charge controller: types of charge controller, function of charge controller, PWM type, MPPT type charge controller, Converters: DC to DC converter and DC to AC type converter. smart grid technology and application, manufacturing technique of solar array

- **Unit 5**

Application of Solar PV system. Solar home lighting system, solar lantern, solar fencing, solar street light, solar water pumping system, Roof top solar photovoltaic power plant and smart grid. Electrical characteristics and Commissioning of complete solar PV system.

Suggested Readings:

- Rai GD. 1998. Non-conventional Sources of Energy. Khanna Pub.
- Rathore N.S., Kurchania A.K., Panwar N.L. 2006. Renewable Energy: Theory & Practice, Himanshu Publications.

STREAMWISE THIRD OPTIONAL COURSES (cont...)

EEM811-ROBOTICS (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2015-16

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 39

• **UNIT 1**

Definitions & Laws of Robots, Evolution of Robots & Robotics, Robots & Robotics, Robot classification, Robot anatomy, Types of joints, Degrees of Freedom, Robot configurations, Workspace, Applications of Robots etc.

• **UNIT 2**

Actuators- pneumatic, hydraulic & electric actuators, dc servomotors & stepper motors Sensors- status sensors viz. potentiometer, tachometer, optical encoders, limit switches etc. - Environment sensors viz., pressure, force, torque, vision, optical, acoustic, infrared, proximity etc. End-effectors- grippers & tools.

• **UNIT 3**

Co-ordinate Frames, Mapping & Transformation between frames, Fundamental Rotation Matrices, Direct Kinematics problem. Inverse Kinematics problem. Representation.

• **UNIT 4**

Newton- Euler's formulation. Lagrange's formulation.

• **UNIT 5**

(a) CONTROL: Various control techniques used (b) TASK LEVEL PLANNING OF ROBOTS: Motion planning with reference to path and trajectory planning (c) ROBOT PROGRAMMING: Various languages used for robot programming with hands on experience.

SUGGESTED READINGS:

- Fu, KS Lee RCCSG: ROBOTICS SENSING, VISION AND INTELLIGENCE
- Richard P Paul, Mikell Grover: ROBOT MATHEMATICS

STREAMWISE THIRD OPTIONAL COURSES (cont...)

MEM809-NANO-TECHNOLOGY & NANO-COMPUTING (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2007-08

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem.: 52

- **UNIT 1**

Nanosystems, Molecular machinery and Manufacturing, quantum mechanics mechanosynthesis, Ideas of Richard Feynman. Nanocomputing: Introduction, Nanocomputing Technologies, Carbon nanotubes, Nano information processing, Silicon Nanoelectronics, Prospects and Challenges.

- **UNIT 2**

Properties, Molecular Structure, Chiral Vector, Carbon nanotube Electronics, Carbon Nanotube Field-effect Transistors.

- **UNIT 3**

Nanocomputing with Imperfections: Nanocomputing in presence of Defects and Faults, Redundancy, Error Control Coding, Reconfiguration, Fault Simulation, Defect Tolerance, Reconfigurable Hardware, Overcoming Manufacturing Defects. Reliability of Nanocomputing: Markov Random Fields, Examples, Reliability Evaluation Strategies, Law of Large Numbers, NANOPRISM.

- **UNIT 4**

Quantum Computers, Challenges to Physical Realization, Quantum-dot Cellular Automata (QCA), QCA Clocking, Design Rules, Placement, Basic QCA Circuits using QCA Designer Software and their implementation.

- **UNIT 5**

Molecular Computing: Background of molecular electronics, Adleman's Experiment, DNA Computation, Bacteriorhodopsin, Challenges before Molecular Computing. Optical Computing: Introduction, use of Optics for Computing, Optical Computing Paradigms, Ultrafast Pulse Shaping, Photonic Switches.

SUGGESTED READING:

- NANO, QUANTUM AND MOLECULAR COMPUTING- IMPLICATIONS TO HIGH LEVEL DESIGN AND VALIDATION: SK Shukla & RI Bahar (Eds.), *Kluwer Academic Publishers*

STREAMWISE THIRD OPTIONAL COURSES (cont...)

MEM811-FUTURES STUDIES (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2013-14

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem.: 52

• **UNIT 1**

Future scan: A tool for management decision; the decision making process: from need to objectives; search for alternatives, precision, assumptions; Conceptualization of decision making, some illustrations.

• **UNIT 2**

Technology forecasting and assessment, Quantitative methods, Regression analysis: time series and Fuzzy time series analysis.

• **UNIT 3**

The morality of systems, A science of values, Consumerism and consumer protection, Social indicator of Quality of life, Measures of Consensus and Agreement, SWOT Analysis, Creative idea engineering: Descriptive and Normative elements; Delphi scenario building methodology: Seth-Harva method, Fuzzy Delphi Method.

• **UNIT 4**

Planning and decision making; Hierarchical modeling, Option Field and Option Profile Methodology, Conflict Resolution: Meta game theory.

• **UNIT 5**

Neural networks, System Dynamics and Quantum computing as a tool for future studies, Preliminary concepts and applications to sample problem, Blue Ocean Strategy, White Mountain strategy: for futuristic Planning.

SUGGESTED READING:

- Roberts: MANAGERIAL APPLICATION OF SYSTEM DYNAMICS RG Coyle: MANAGEMENT SYSTEM DYNAMIC
- PS Satsangi & V S Gautam: MANAGEMENT OF RURAL ENERGY SYSTEM

STREAMWISE THIRD OPTIONAL COURSES (cont...)

MEM814-MANAGEMENT INFORMATION SYSTEMS (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2013-14

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 52

- **UNIT 1**

Information Systems (IS) in Global Business Today: Characteristics of the digital world, Role of IS, IS defined, Purpose of IS, Dimensions of IS, Components of IS, types of IS, Dimensions of IS, Ethical and Social Issues in IS, Managing Knowledge, Dimensions of Knowledge, Use of IS.

- **UNIT 2**

Gaining competitive advantage through IS: IS for automating, IS for organizational learning, IS for supporting strategy, freeconomics.

- **UNIT 3**

IT infrastructure and emerging technologies : IT infrastructure, Contemporary Hardware & Software Platform Trends, Convergence of Computing & Telecommunications, RFID & Wireless Sensor Networks, e-business, e-commerce and e-government.

- **UNIT 4**

Achieving Operational Excellence and Customer Intimacy: Enterprise Applications: Enhancing communication / cooperation / collaboration / connection / business intelligence using IS. Database approach to IS: Entry and Querying Data, Data Warehouses, Data Mining, Decision Support Systems, Online Transaction Processing, Online Analytic Processing, Intelligent Systems, Knowledge Management Systems.

- **UNIT 5**

Developing and Acquiring Information Systems and Outsourcing. Enterprise Information Systems.

SUGGESTED READING:

- Kenneth C Laudon & Jane P Laudon: MANAGEMENT INFORMATION SYSTEMS, 12e, Pearson Education
- Joseph Valacich & Christoph Schneider: INFORMATION SYSTEMS TODAY, 5e, Pearson Education

STREAMWISE THIRD OPTIONAL COURSES (cont...)

MEM827-OPERATION MANAGEMENT (3.0)

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2013-14

Total Credits: 3, Periods (55 mts. each)/week: 3(L-3+T-0+P/S-0), Min.pds./sem.: 52

• **UNIT 1**

Introduction to operations management; competitiveness; strategy; factors affecting productivity; Measurement of Productivity, Product / Service design; Design for Manufacture. Growing importance of Quality, QFD and TQM.

• **UNIT 2**

Location Planning: Need for Location Decisions, Location Decision Factors, Trends in Locations, qualitative and quantitative methods for evaluating Locations. Process Selection and Facility, Layout: Process types and selection. Classification of production systems and types of layouts. Line balancing. Designing process layouts.

• **UNIT 3**

Forecasting requirements, importance and basic categories. Qualitative methods: Delphi method, Market research, Expert judgment. Quantitative methods: Moving Average, Exponential Smoothing, Seasonal Method, Causal Methods: Regression and Multiple Regression. Accuracy and control of forecasts.

• **UNIT 4**

Inventory: Types, requirements, scope, and functions. Independent vs. Dependent Demand., Inventory Costs. Economic Order Quantity. Quantity Discounts. Material Requirements Planning (MRP): MRP inputs, MRP processing, MRP outputs. Manufacturing Resource Planning (MRP II). Logistics and Supply Chain Management.

• **UNIT 5**

Job Shop Scheduling: Gantt charts. Static and Dynamic Scheduling. Optimal Approaches - Johnson's and Jackson's Algorithms; Heuristic Approaches: Priority Dispatching Rules. Project Scheduling: Precedence diagrams. Critical Path Method (CPM). Program Evaluation and Review Technique (PERT). Project Crashing.

SUGGESTED READINGS:

• OPERATIONS MANAGEMENT by Gaither and Frazier, Thomson Learning

Thank you...!!!

APPENDIX

FIRST SEMESTER

Course Number	Course Title	Credits	End Sem. Exam.	Theory/ Practical
CHM181	APPLIED CHEMISTRY	3.0	Y	T
CHM182	APPLIED CHEMISTRY LAB.	1.0	Y	P
PHM181	APPLIED PHYSICS I	3.0	Y	T
PHM182	APPLIED PHYSICS LAB.	1.0	Y	P
MEM101	GRAPHIC SCIENCE	3.0	Y	T
MEM102	ENGINEERING DRAWING I	3.0	Y	P
MEM103	MANUFACTURING PROCESSES I	3.0	Y	T
MEM104	WORKSHOP PRATICE I	1.0	Y	P
MAM181	ENGINEERING MATHEMATICS I	3.0	Y	T
RDC181	AGRICULTURAL OPERATIONS I	1.0	N	P
RDC182	SOCIAL SERVICE	1.0	N	P
GKC181	SC.METH., G.K. & CURRENT AFFAIRS I	1.0	N	T
	Total Credits	27.0		

ANCILLARY COURSE (ON A CHOSEN SUBJECT) ANYONE COURSE FROM

BBH101	BUSINESS ORGANISATION	3.0	YES	T
BOH181	ENVIRONMENTAL SCIENCES	3.0	YES	T
CEH181	THEORY OF DESIGN	3.0	YES	T
DBD101	BASIC STATISTICS	3.0	YES	T
DPH181	ART APPRECIATION	3.0	YES	P
ECH181	ESSENTIAL OF ECONOMICS	3.0	YES	T
ENH181	ENGLISH	3.0	YES	T
MUH181	SANGEET KRIYATMAK	3.0	YES	P
OMH101	COMMUNICATION TECHNIQUE HINDI I	3.0	YES	T
PYH181	INTRODUCTION TO PSYCHOLOGY	3.0	YES	T

SECOND SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
PHM281	APPLIED PHYSICS II	3.0	Y	T
PHM282	APPLIED PHYSICS LAB	1.0	Y	P
EEM201	COMPUTER CONCEPTS & C PROGRAMMING	3.0	Y	T
EEM202	BASIC ELECTRICAL ENGINEERING	3.0	Y	T
MEM201	ENGINEERING THERMODYNAMICS	3.0	Y	T
MEM202	ENGINEERING MECHANICS I	3.0	Y	T
MEM203	ENGINEERING DRAWING II	3.0	Y	P
MAM281	ENGINEERING MATHEMATICS II	3.0	Y	T
EGC281	INDUSTRIAL VISITS	1.0	N	P
ESC281	ENVIRONMENTAL STUDIES	2.0	N	T
GKC281	SC.METH., G.K. & CURRENT AFFAIRS I	1.0	N	T
RDC281	AGRICULTURAL OPERATIONS II	1.0	N	P
RDC282	SOCIAL SERVICE	1.0	N	P
CAC281	CO-CURRICULAR ACTIVITIES	3.0	N	P
#	ANCILLARY COURSE	3.0	Y	T
TOTAL CREDITS		35		

COURSE AND CREDIT DETAILS OF CURRICULUM

Sl No	Disciplines	No of courses		Total credits	
		Theory	Practical	Theory	Practical
1	Agricultural Engineering core courses	28	13	74	15
2	Applied Sciences and Basic Engineering	23	12	67	16
3	University Core courses	12	2	26	2
4	Experiential Learning	0	17	0	17
Total		63	44	167	64
		107		131	
Total credits = 231					

AGRICULTURAL ENGINEERING CORE COURSES

FARM MACHINERY AND POWER ENGINEERING

COURSE TITLE	Semester	Stream	Status
REPAIR OF FARM EQUIPMENT	4	Common	elective
FARM MACHINERY AND EQUIPMENT I	5	Common	compulsory
FARM MACHINERY AND EQUIPMENT I LAB	5	Common	compulsory
TRACTOR AND AUTOMOBILE ENGINES	5	Common	compulsory
STATIONARY AND AUTOMOTIVE ENGINES LAB	5	Common	compulsory
MACHINE DESIGN	6	Common	compulsory
DESIGN PRACTICE AND CAD APPLICATIONS	6	Common	compulsory
TRACTOR SYSTEMS AND CONTROLS	8	mainstream	compulsory
FARM MACHINERY AND EQUIPMENT II	6	Common	compulsory
FARM MACHINERY AND EQUIPMENT II LAB	6	Common	compulsory
FARM MACHINERY DESIGN AND PRODUCTION	7	mainstream	Elective
HYDRAULIC DRIVES AND CONTROLS	8	Mainstream	elective2

AGRICULTURAL ENGINEERING CORE COURSES (cont...)

IRRIGATION AND DRAINAGE ENGINEERING+SOIL AND WATER CONSERVATION ENGINEERING

COURSE TITLE	Semester	Stream	Status
SOIL MECHANICS	3	Common	compulsory
SOIL TECH LAB	3	Common	compulsory
IRRIGATION ENGINEERING	4	Common	compulsory
IRRIGATION ENGINEERING LAB	4	Common	compulsory
GEOMATICS I	4	Common	compulsory
GEOMATICS LAB	4	Common	compulsory
ENERGY AUDITING FOR POLYHOUSE & FARM STRUCTURES	4	Common	elective
SOIL AND WATER CONSERVATION ENGINEERING	5	Common	compulsory
DRAINAGE ENGINEERING	6	Mainstream	Compulsory
WATERSHED HYDROLOGY, PLANNING AND MANAGEMENT	6	Common	compulsory
REMOTE SENSING AND GIS	6	Common	compulsory
SOIL AND WATER LAB	6	Common	compulsory
WATER HARVESTING AND SOIL CONSERVATION STRUCTURES	7	Mainstream	compulsory
INFORMATION TECHNOLOGY FOR LAND AND WATER MANAGEMENT	6	Agritech	Elective
GROUND WATER WELL AND PUMPS	7	mainstream	compulsory
HYDROLOGY LAB	7	mainstream	compulsory
PRECISION FARMING TECHNIQUES FOR FIELD AND PROTECTED CROP PRODUCTION	8	Mainstream	Elective1
SPRINKLER AND MICRO IRRIGATION SYSTEM	8	Mainstream	elective2
PLASTIC APPLICATION IN AGRICULTURE	8	Mainstream, dairy engg	elective1
WASTELAND DEVELOPMENT	8	Mainstream	Elective2

AGRICULTURAL ENGINEERING CORE COURSES (cont...)

POSTHARVEST PROCESS ENGINEERING

COURSE TITLE	Semester	Stream	Status
ENGINEERING PROPERTIES OF AGRICULTURAL PRODUCE	4	common	compulsory
AGRICULTURAL STRUCTURES AND ENVIRONMENT CONTROL	6	common	compulsory
SEED PROCESSING TECHNOLOGY	7	mainstream	elective
AGROECOLOGY AND FOOD SUSTAINABILITY	5	Common	compulsory
CROP PROCESSING ENGINEERING	5	Mainstream	Compulsory
CROP PROCESS ENGINEERING LAB	5	Mainstream	Compulsory
POSTHARVEST ENGINEERING OF HORTICULTURE CROPS	8	Mainstream	elective1
PACKAGING TECHNOLOGY	8	Mainstream, dairy engg	elective2

RENEWABLE ENERGY

COURSE TITLE	Semester	Stream	Status
RENEWABLE POWER SOURCES	6	common	compulsory
BIO ENERGY SYSTEMS	7	mainstream	elective
PHOTOVOLTAIC TECHNOLOGY AND SYSTEMS	8	common	elective 3

AGRICULTURAL ENGINEERING CORE COURSES (cont...)

OTHER CORE COURSES COMMON TO DIFFERENT STREAMS

COURSE TITLE	Semester	Stream	Status
PRINCIPLES OF AGRONOMY	3	Common	compulsory
AGRONOMYLAB	3	Common	compulsory
HORTICULTURE CROP MANAGEMENT	4	Common	compulsory
FARM BUSINESS MANAGEMENT AND VILLAGE INDUSTRIES	7	Common	compulsory
PROFESSIONAL ETHICS AND CONSCIOUSNESS	7	Common	compulsory
SEED PROCESSING TECHNOLOGY	7	Mainstream	elective
DESIGN OF STRUCTURES	7	Mainstream	elective
AGRICULTURE DATA ANALYTICS	7	Mainstream	elective
HUMAN ENGINEERING AND SAFETY	7	Mainstream, dairy engg	elective
ADDITIVE MANUFACT. FOR 3D PRINTING & LAB	7	Common	elective
AGRICULTURE EXTENSION	8	Common	compulsory
AGRICULTURE EXTENSION PRACTICE	8	Common	compulsory
MECHATRONICS	8	Mainstream, dairy engg	Elective1
HYDRAULIC DRIVES AND CONTROLS	8	Mainstream	Elective2
WASTE AND BY PRODUCT UTILIZATION	8	Mainstream	Elective2
SOFT COMPUTING IN AGRICULTURE SYSTEMS	8	Mainstream	Elective2
PRECISION AGRICULTURE AND SYSTEM MANAGEMENT	8	Common	Elective3

MAINSTREAM courses are covered in the courses listed above

AGRICULTURAL ENGINEERING CORE COURSES (cont...)

DAIRY ENGINEERING (*Specialization*)

Subject	Sem	Status
INTRODUCTION TO DAIRY FARMING	5	Compulsory
DAIRY FARMING LAB	5	Compulsory
RHEOLOGY OF DAIRY PRODUCTS	6	Compulsory
DAIRY ENGINEERING	7	Compulsory
DAIRY ENGINEERING LAB	7	Compulsory
FOOD QUALITY AND CONTROL	7	Compulsory
HUMAN ENGINEERING AND SAFETY	7	elective
NUTRITIONAL MANAGEMENT IN DAIRY FARM	7	elective
FOOD PLANT DESIGN AND MANAGEMENT	8	compulsory
DEVELOPMENT OF PROCESSED PRODUCTS	8	elective1
PROCESS EQUIPMENT DESIGN	8	elective2

AGRICULTURAL ENGINEERING CORE COURSES (cont...)

AGRITECH & ENTREPRENEURSHIP (*Specialization*)

Subject	Sem	Status
IOT IN AGRICULTURE SYSTEMS	5	Compulsory
IOT LAB	5	Compulsory
AI AND MACHINE LEARNING IN AGRICULTURE	7	Compulsory
MODERN AGRITECH LAB	7	Compulsory
AGRICULTURE MARKETING TRADE & PRICES	7	Compulsory
AGRICULTURE DATA ANALYTICS	7	elective
UAV IN AGRICULTURE	7	elective
SENSORS AND MICRO CONTROLLERS	7	elective2
CONSUMER BEHAVIOUR & ANALYSIS	8	compulsory
INTELLETUAL PROPERTY RIGHT	8	Elective1
PREDICTIVE ANALYTICS IN AGRICULTURE	8	Elective1
9-Agritech; 4-Entrepreneurship		

EXPERIENTIAL LEARNING COURSES

COURSE TITLE	Semester	Stream	Status
AGRICULTURAL OPERATIONS I	1	Common	compulsory
INDUSTRIAL VISITS	2	Common	compulsory
AGRICULTURAL OPERATIONS II	2	Common	compulsory
PRODUCT MANUFACTURING PROJECT	3	Common	compulsory
PRACTICAL TRAINING	3,5	Common	compulsory
INDUSTRIAL VISIT	4	Common	compulsory
DESIGN ENGG./THEME DEVELOP. PROJECT	5,6	Common	compulsory
EXPERIENTIAL LEARNING	6	Common	compulsory
STREAM SEMINAR	6	Common	compulsory
AGRICULTURAL ENGINEERING PROJECT I	7	Common	compulsory
SEMINARS	7	Common	compulsory
CO-OP TRAINING AND EXPERIENTIAL LEARNING	7	Common	compulsory
MINOR PROJECT-I	7	Common	compulsory
AGRICULTURAL ENGINEERING PROJECT II	8	Common	compulsory
MINOR PROJECT-II	8	Common	compulsory