

**MRSPTU B.TECH. AGRICULTURE ENGG. SYLLABUS 2016 BATCH ONWARDS
UPDATED ON 13.11.2018**

SEMESTER 3 rd		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BAGE2-301	Agriculture for Engineers	3	1	0	40	60	100	4
BAGE2-302	Farm Machinery	3	1	0	40	60	100	4
BAGE2-303	Thermodynamics and Heat Engine	3	1	0	40	60	100	4
BAGE2-304	Wasteland Development	3	1	0	40	60	100	4
BAGE2-305	Irrigation Engineering	3	1	0	40	60	100	4
BAGE2-306	Agriculture for Engineers Lab	0	0	2	60	40	100	1
BAGE2-307	Farm Machinery Lab	0	0	2	60	40	100	1
BHUM0-F91	Soft Skills-I	0	0	2	60	40	100	1
BAGE2-308	Institutional Training*	0	0	4	60	40	100	2
Total		15	5	10	440	460	900	25

* Institutional Training after 2nd semester during summer vacations

SEMESTER 4 th		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BAGE2-409	Surveying and Levelling	3	1	0	40	60	100	4
BAGE2-410	Theory of Machines	3	1	0	40	60	100	4
BAGE2-411	Engineering Economics	4	0	0	40	60	100	4
BAGE2-412	Soil & Water Conservation Engineering	3	0	0	40	60	100	3
BAGE2-413	Farm Power	3	1	0	40	60	100	4
BAGE2-414	Surveying and Levelling Lab.	0	0	2	60	40	100	1
BAGE2-415	Theory of Machines Lab.	0	0	2	60	40	100	1
BAGE2-416	Soil & Water Conservation Engineering Lab.	0	0	2	60	40	100	1
BHUM0-F92	Soft Skills-II	0	0	2	60	40	100	1
Total		16	3	8	440	460	900	23

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SEMESTER 5 TH		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BAGE2-517	Agricultural Structure and Environmental Control	3	0	0	40	60	100	3
BAGE2-518	Soil and Water Conservation Structures	3	1	0	40	60	100	4
BAGE2-519	Dairy and Food Engineering	2	1	0	40	60	100	3
BAGE2-520	Tractor System, Controls & Operation	3	1	0	40	60	100	4
BAGE2-521	Soil and Water Conservation Structures Lab.	0	0	2	60	40	100	1
BAGE2-522	Tractor System, Controls & Operation Lab.	0	0	2	60	40	100	1
BAGE2-523	Dairy and Food Engineering Lab.	0	0	2	60	40	100	1
BAGE2-524	Training-II*	0	0	4	60	40	100	2
BHUM0-F93	Soft Skills-III	0	0	2	60	40	100	1
Open Elective – I		3	0	0	60	40	100	3
Total		14	3	12	520	480	1000	23

• 4 weeks training after 4th semester during summer vacations

SEMESTER 6 TH		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BAGE2-625	Engineering Hydrology	3	1	0	40	60	100	4
BAGE2-626	Engineering Properties of Biological Material & Food Quality	3	1	0	40	60	100	4
BAGE2-627	Drainage Engineering	2	1	0	40	60	100	3
BAGE2-628	Hands on Training in CAD/CAM	3	0	0	40	60	100	3
BAGE2-629	Engineering Hydrology Lab.	0	0	2	60	40	100	1
BAGE2-630	Engineering Properties of Biological Material & Food Quality Lab.	0	0	2	60	40	100	1
BAGE2-631	Drainage Engineering Lab.	0	0	2	60	40	100	1
BHUM0-F94	Soft Skills- IV	0	0	2	60	40	100	1
Open Elective – II		3	0	0	40	60	100	3
Total		14	3	8	440	460	900	21

After 6th semester, student will go for 8 Weeks in house / Industrial Training, present a seminar and submit a report in defined format to the department.

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SEMESTER 7 TH		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BAGE2-732	Ground Water, Well & Pumps	3	1	0	40	60	100	4
BAGE2-733	Micro Irrigation Systems & Design	2	1	0	40	60	100	3
BAGE2-734	Food Processing Plant Design & Layout	3	1	0	40	60	100	4
Open Elective-III		3	0	0	40	60	100	3
BAGE2-735	Ground Water, Well & Pumps Lab.	0	0	2	60	40	100	1
BAGE2-736	Micro Irrigation Systems & Design Lab.	0	0	2	60	40	100	1
BAGE2-737	B. Tech. Project-I	0	0	4	60	40	100	2
BAGE2-738	Training-III #	0	0	8	60	40	100	4
Total		11	3	16	400	400	800	22

SEMESTER 8 TH		Contact Hrs.			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BAGE2-839	Crop Process Engineering	3	1	0	40	60	100	4
BAGE2-840	Watershed Planning and Management	3	1	0	40	60	100	4
BAGE2-841	Crop Process Engineering Lab.	0	0	2	60	40	100	1
BAGE2-842	Watershed Planning and Management Lab.	0	0	2	60	40	100	1
BAGE2-843	B. Tech. Project-II	0	0	10	60	40	100	5
BAGE2-844	Seminar	0	0	2	100	0	100	1
Total		6	2	16	360	240	600	16

AGRICULTURE FOR ENGINEERS

Subject Code: BAGE2-301

L T P C
3 1 0 4

Duration: 48 Hrs.

Course Objectives:

This course includes with a fairly good concept of the fundamentals of different topics related to Agriculture field like Soil Science, organic matter availability in soil, agronomy, horticulture and layout etc.

Course Outcomes:

The Students will understand the different types of soils, rocks, characteristics and Identifications.

1. The Students will understand the layout and planting methods of horticultural crops.
2. Identify the different types of soil and organic matters.
3. Identify the different types of equipment for tillage operations.
4. The students will able to understand about the essential plants nutrients.

Unit - I (12 Hrs.)

Soil Characteristics: 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 inorganic colloids – their composition, Ion exchange in soil and nutrient availability.

Unit – II (12 Hrs.)

Soil Organic Matter: Its composition and decomposition, effect on soil fertility, saline and sodic soils Quality or irrigation water, Essential plants nutrients, Functions and deficiency symptoms in plants, Important inorganic fertilizers and their reactions in soils. Soil water plant relationship, Crop rotation, cropping systems, Mixed cropping, Relay cropping

Unit - III (10 Hrs.)

Agronomy: Definition and scope of agronomy, Classification of crops, Effect of different weather parameters on crop growth and development, Principles of tillage, Tilt and its characteristics,

Horticulture: Scope of horticultural and vegetable crops, Soil and climatic requirements for fruits Soil and climatic requirements for Vegetables, improved varieties of horticulture crops High-tech horticulture- Poly-houses for flowers and vegetables.

Unit –IV (14 Hrs.)

Criteria for Site Selection of Horticulture Crops: Layout and planting methods, Nursery raising, Macro and micro propagation methods, Pant growing structures, Pruning & training, Fertilizer application process, Fertigation, Harvesting, Grading and packaging, Post-harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds.

Recommended Books:

1. T.D. Biswas and S.K. Mukherjee, 'Soil Science', TMH Publication.
2. T. Yellamanda and G.H. Sankara Reddy, 'Principle of Agronomy', Kalyani Publication.
3. Jitendra Singh, 'Basic Horticulture', Kalyani Publisher.
4. K.K. Mehta, 'Reclamation of Alkali Soil in India', Oxford & IBH.
5. Maharaj Singh, 'Education for Sustainable Agriculture', Indian J. Agronomy.

FARM MACHINERY

Subject Code: BAGE2-302

L T P C
3 1 0 4

Duration: 48 Hrs.

Course Objectives:

Farm machinery is utilizing different sources of power and mechanization achieved through the design, development, testing and adaptation of farm implements and. Today farm labour is

becoming scarce and expensive day by day. It is also necessary to reduce the cost of cultivation of Different crops.

Course Outcomes:

1. To identify the need of farm mechanization in India and evaluation of tillage, sowing in farming.
2. To abreast the students with mathematical, experimental and computational skills for solving
3. different field problems.
4. To develop skills in the students required to develop and modification of farm machineries.
5. To identify the need of earth moving equipment and their importance in farming.

Unit – I (12 Hrs.)

Tillage: primary and secondary tillage equipment, Zero and conservation tillage equipment Forces acting on tillage tools, Hitching systems and controls, Measurement of forces of tillage tools, Draft measurement of tillage equipment, Types of dynamometer; spring type, Hydraulic type and strain gauge types.

Unit – II (10 Hrs.)

Objectives of Farm Mechanization: Classification of farm machines, Materials of construction and heat treatment, Principles of operation and selection of machines used for production of crops, field capacities and economics.

Unit – III (12 Hrs.)

Earth Moving Equipment: Their construction & working principles, Bulldozer, Elevators, Scraper and Digger, Sowing, planting & transplanting equipment, various type Zero till ferti-drill Seed and planting metering devices, their calibration and adjustments. Furrow openers and covering devices, Fertilizer application equipment and their metering devices.

Unit – IV (14 Hrs.)

Weed control and Plant protection equipment- sprayers and dusters, their calibration selection, constructional features of different components, harvesting machinery- mowers, windrowers, reapers, reaper binders and forage harvesters, forage chopping & handling equipment, Description working principle of threshing machineries, grain and straw combine.

Recommended Books:

1. R.A. Kepner, Roy Bainer, 'Principles of Farm Machinery,' CBS Publication.
2. Radhey Lal, 'Agricultural Engineering', Saroj Publication.
3. Jagdishwar Sahay, 'Elements of Agricultural Engineering', Standard Publishers Distributors.
4. R. Suresh, 'Farm Power and Machinery Engineering', Standard Publishers Distributors.
5. Triveni Singh Prasad, 'Farm Machinery,' PHI, 2016.

THERMODYNAMICS AND HEAT ENGINE

Subject Code: BAGE2-303

L T P C

Duration: 46 Hrs.

3 1 0 4

Course Objectives:

This course is designed for comprehensive study of combustion and thermal aspects in internal combustion engines, steam power plants and its allied components. This will enable the students to understand combustion phenomenon and thermal analysis of steam power plant components.

Course Outcomes:

The students will be able to-

1. Understand the Basic principles of thermodynamics like conservation of mass, conservation of energy and the second law of thermodynamics.
2. Analyse the performance of various power cycles and to identify methods for improving thermodynamics performance.
3. Analyse the working, efficiency, process of Otto, diesel and dual cycle.
4. Carry out simple analysis on internal combustion engines.

Unit – I (10 Hrs.)

Thermodynamics Properties: Closed and open system Flow and non-flow processes Gas laws of thermodynamics Internal Energy Application of first law in heating and expansion of gases in non-flow processes First law applied to steady flow processes.

Unit – II (10 Hrs.)

Second Law of Thermodynamics: Kelvin-Planck statement, Clausius Statement, Reversible processes, Carnot cycle, Carnot theorem, Steam Generator- Classification of steam boilers, Lancashire boiler, Locomotive boiler, Boiler mountings, Boiler accessories, Desirable properties of working fluid used for power plants, Rankine cycle

Unit – III (12 Hrs.)

Entropy: Physical concept of entropy, Change of entropy of gases at constant volume, Change of entropy of gases at constant Pressure, Change of entropy of gases at constant Temperature, Change of entropy of gases at reversible adiabatic process Change of entropy of gases at poly tropic process.

Unit – IV (14 Hrs.)

Thermodynamic Air Cycle: Air Standard efficiency, Engine efficiencies and terms, Otto cycle, Diesel cycle, Dual cycle, mean effective pressure, Measurement of IP and BP, HBC.

Recommended Books

1. D.S. Kumar, 'Thermodynamics', Katson Publication 1st Edition, **2009**.
2. D.K. Jha, 'A Text Book of Thermodynamics', Discovery Publishing House.
3. R.S. Khurmi & J.K. Gupta, 'A Text Book of Thermal Engineering,' S. Chand & Company Limited, reprint **2002**.
4. P.K. Nag, 'Engineering Thermodynamics', TMH Publication.
5. R. Yadav, 'Thermodynamics and Heat Engines', Central Publishing House, **2002**.

WASTELAND DEVELOPMENT

Subject Code: BAGE2-304

**L T P C
3 1 0 4**

Duration: 46 Hrs.

Course Objectives:

To improve resources conservation (soil and water) and land use and maximizing productivity per unit area, per unit time and per unit of water. This course includes the study of how to wasteland land Reclamation by the different ways like Afforestation, reforestation, topographic condition of soil, conservative structures etc.

Course Outcomes:

The students will able to-

1. Theoretical knowledge of identifying the arid, semi-arid, humid and sub humid regions.
2. The students will able to conserving the land against its degradation.
3. The students will able to know about uses of structures in conservation of land.
4. The students will able to know about the wasteland treatment under micro irrigation.

Unit – I (10 Hrs.)

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

Unit – II (12 Hrs.)

Conservation Structures: Gully stabilization, ravine rehabilitation, sand dune stabilization, water harvesting and recycling methods (In brief). **Afforestation**-Agro-horti-forestry Silvopasture methods forage and fuel crops– socioeconomic constraints, Shifting cultivation, optimal land use options.

Unit – III (12 Hrs.)

Wasteland Development: Hills, semi-arid, coastal areas, water scarce areas, reclamation of waterlogged and salt-affected lands. Mine spoils- impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management.

Unit-IV (12 Hrs.)

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

Recommended Books

1. I.P. Abrol and V.V. Dhruva Narayana, 'Technologies for Wasteland Development,' ICAR, New Delhi, 1998.
2. S.K. Ambast, S.K. Gupta and Gurbachan Singh, 'Agricultural Land Drainage – Reclamation of Waterlogged Saline Lands'.
3. H.R. Yadav, 'Management of Wastelands', Concept Publishing Company, New Delhi.
4. S.C. Kalwar, 'Wastelands and Planning for Development', Concept Publishing Company 2008.
5. C. Karthikeyan, K. Thangaraja, C. Cinthia Fernandez and K. Chandrakandon, 'Dryland Agriculture and Wasteland Management', Atlantic Publishers, New Delhi, 2009.

IRRIGATION ENGINEERING

Subject Code: BAGE2-305

**L T P C
3 1 0 4**

Duration: 46 Hrs.

Course Objectives:

To study the techniques of irrigation methods and understand the various technologies of irrigation. This course learns about the acquire knowledge of irrigation water, use of irrigation water in field, understand different irrigation methods and effective usage of water resources.

Course Outcomes:

1. To provide a sound theoretical knowledge applied to water resources and agricultural engineering.
2. The students will able to understand the requirements of crop water.
3. The Students will understand the importance of water quality for beneficial uses, especially irrigation and its management.
4. To develop innovative capacity of students for increasing agricultural production with scarce water resources available.

Unit- I (10 Hrs.)

Source of irrigation water, measurement of irrigation water, infiltration, application of soil plant atmospheric continuum and principles of fluid mechanics to design of irrigation system, water balance equation and evaluation of different components; measurement of evaporation and evapo-transpiration.

Unit- II (12 Hrs.)

Water resource development and utilization in India, Surface water resources ground water resources, India's water budget, utilization of water resources, factors a fleeting water utilization, major river basins of India

Unit- III (10 Hrs.)

History and development of Irrigation in India, Classification of irrigation projects, canal network, water distribution pattern, system of levying irrigation charges.

Unit- IV (14 Hrs.)

Estimation of irrigation water requirement and irrigation scheduling: efficiencies of irrigation systems, Hydraulics, Design and evaluation of surface, sub-surface, overhead and drip irrigation

systems; design of water conveyance systems including control structures, design principles, Selection of pumps and prime movers.

Recommended Books:

1. A.M. Michael, 'Irrigation Theory and Practice', Vikas Publications, New Delhi.
2. S.K. Majumdar, 'Irrigation Engineering', Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1983.
3. Om Prakash, 'Irrigation and Water Management', Rama Publishing House, Meerut.
4. K.K. Schwab, 'Soil and Water Conservation Engg.' John Wiley and Sons Inc. New York.
5. R. Lal 'Irrigation Hydraulics', Saroj Prakashan, Allahabad, 1978.
6. N.N. Basak, 'Irrigation Engineering', McGraw Hill Education, 1999.

AGRICULTURE FOR ENGINEERS LAB.

Subject Code: BAGE2-306

L T P C

0 0 2 1

EXPERIMENTS

1. Study of Garden tools, implements and plant protection equipment.
2. Identification of rocks and minerals.
3. Study of manures and fertilizers.
4. Study of layout in different irrigation systems.
5. To study of Pruning and training of orchard trees.
6. Examination of soil profile in the field.
7. Determination of bulk density.
8. Identification of weeds.
9. Determination particle density and porosity of soil.
10. Study of different Cultivator.
11. Study of different weed control methods.
12. Determination of organic carbon of soil.
13. Fertilizer application methods.
14. Study of different orchard layout methods.
15. Identification of crops and their varieties seeds.

FARM MACHINERY LAB.

Subject Code: BAGE2-307

L T P C

0 0 2 1

EXPERIMENTS

1. To study animal drawn and tractor drawn mould Board ploughs.
2. Introduction to various farm machineries.
3. To study Indigenous or country plough.
4. To study the starting and stopping of Diesel Engine.
5. Introduction, construction and working of earth moving equipment.
6. To study four stroke cycle engine.
7. Construction and working of rotavator and other rotary tillers.
8. To study cultivators and its important functions.
9. Weeding equipment- their use and adjustment
10. Field operation of showing and planting equipment and their adjustments.
11. Field capacity and field efficiency measurement for at least two machines/implements.
12. Working of Paddy Transplanter and their calibration.
13. To Study the field capacity of sprayer and duster.
14. To study Air cooling system and its advantages.

15. Study on methods of repair, maintenance and off season storage of farm equipment.
16. Working of seed-cum-fertilizer drills and their calibration.

SOFT SKILLS-I

Subject Code: BHUM0-F91

L T P C
0 0 2 1

Course Objectives:

The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes:

At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

Soft Skill: Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.

Self-Discovery: Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

Forming Values: Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

Art of Listening: Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

Etiquette and Manners: ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

Recommended Books:

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Learning, New Delhi, 2010.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, 2016.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, 2007.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, 2011.

SURVEYING AND LEVELLING

Subject Code: BAGE2-409

L T P C
3 1 0 4

Duration: 48 Hrs.

Course Objectives:

This course introduces to students the theory and application of surveying and to make well understands the fundamentals of surveying knowledge and being familiar with various aspects of surveying practice. It has ability to apply the knowledge of mathematics science and engineering to understand the measurement technique and equipment used in land surveying.

Course Outcomes:

The students should be able to-

1. Demonstrate knowledge of various surveying methods.
2. Conduct a chain survey and compass survey.
3. Conduct levelling survey and be able to do RL calculations.
4. Demonstrate knowledge of properties of various building materials.

Unit – I (12 Hrs.)

Surveying: Principle and basic concepts of surveying, Plans and maps, Classification of surveying, basic measurements, Units of measurement, Types of Scales, Recording the measurement, Principal of chain surveying, Types of Chains, Types of Ranging Chaining Chain and tape errors and corrections, Selection of survey station and lines, offset measurement, Obstacles in chaining and ranging.

Unit – II (12 Hrs.)

Traversing: Methods of traversing, Prismatic compass, Surveyors compass Angle and bearing, quadrantal system, Local attraction, Dip of angle, magnetic declination, Plotting a traverse survey, Errors in compass survey, Bow ditch's rule, Transit rule.

Unit – III (10 Hrs.)

Plane Tabling: Plane tabling instruments and accessories, Methods and principal, two points problem, three points problem, Errors in plane tabling.

Theodolite: Theodolite traversing, Theodolite Surveying, Ranging by theodolite, Temporary and Permanent adjustment of theodolite.

Unit – IV (14 Hrs.)

Levelling: Definition, Basic principal of levelling, Benchmark, Types of levels optical, Principal causes telescopes sensitivity of bubble tubes, levelling staff, Temporary adjustment,

Permanent adjustment of levels, Field book entries, types of levelling, Simple and differential levelling, Check levelling & reciprocal levelling, Precise levelling, profile levelling

Recommended Books:

1. B.C. Punamia, 'Surveying and Levelling', Vol-I & Vol-II, Laxmi Publications, 2005.
2. Kanetkar & Kulkarni, 'Surveying and Levelling Part-1', Vidarthi Griha Prakashan, Pune.
3. S.K. Duggal, 'Surveying', Vol I & II, Tata McGraw Hill, 2006.
4. R. Agor, 'Surveying', Khanna Publishers.
5. S.S. Bhavikatti, 'Surveying & Levelling', Vol. I & II, **2009.**

THEORY OF MACHINES

Subject Code: BAGE2-410

**L T P C
3 1 0 4**

Duration: 46 Hrs.

Course Objectives:

This course has been designed to cover the basic concepts of kinematic aspects of mechanical machines and major parts used in running of the machines. The students will understand the basic concepts of machines and able to understand constructional and working features of important machine elements.

Course Outcomes:

The students should be able to-

1. Draw inversions and determine velocity and acceleration of different mechanisms.
2. Understand various parts involved in kinematics of machines.
3. Construct different types of cam profile for a given data.
4. Know about clutch, belt, gear system, governor system.

Unit – I (12 Hrs.)

Elements, links, pairs, kinematics chain, and mechanisms, classification of pairs and mechanisms, Lower and higher pairs, four bar chain, slider crank chain and their inversions, Degree of freedom, Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centres.

Unit – II (12 Hrs.)

Cam, Types of cam, Terminology used in cam-follower system, Cam profile, Gear train, Simple, compound, reverted, and epicyclic gear trains, Determination of velocity ratio and train value by tabular method.

Unit – III (10 Hrs.)

Introduction to Belt drives, types of drives, belt materials, Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. Effect of centrifugal tension, Creep and Slip on power transmission, Chain drives.

Unit – IV (12 Hrs.)

Introduction to Clutches, Types of clutches (Single disc, multiple disc, and cone clutches). Balancing of rotating masses in one and different planes,

Governor: Introduction, Types, Constructional details and Analysis of Watt, Porter, Proell governor, Sensitiveness, stability, hunting, isochronisms, power and effort of a governor, flywheel.

Recommended Books:

1. R.S. Khurmi, 'Theory of Machines', S. Chand Publication.
2. S.S. Rattan, 'Theory of Machines', 4th Edn., McGraw Hill Education Publication.
3. Jagdish Lal, 'Theory of Mechanisms & Machines', Metropolitan Book Co.
4. V.P. Singh, 'Theory of Machines', Dhanpat Rai Pub.
5. Thomas Beven, 'Theory of Machines', Longman's Green & Co., London.

ENGINEERING ECONOMICS

Subject Code: BAGE2-411

**L T P C
4 0 0 4**

Duration: 46 Hrs.

Course Objectives:

This includes the study of trading, growth, money, income, depression, prices, and monopoly. Economics is important in the world because it can answer questions such as what causes of Inflation and why are people unemployed? Economics includes the study of labour, land, and investments, of money, income, and production etc.

Course Outcomes:

The Students should be able-

1. Understand the concept of macroeconomic equilibrium and implications for the management of the business cycle.
2. Understand the costs of production and profit-maximization.
3. Understand and apply supply and demand analysis to relevant economic issues.
4. Distinguish between perfect competition and imperfect competition and be able to explain the welfare loss in non-competitive markets.

Unit – I (12 Hrs.)

Economics: Definitions, Nature, Scope, Difference between Microeconomics and Macroeconomics, theory of demand & supply; meaning, determinants, law of demand, law of supply Equilibrium between demand and supply elasticity, price elasticity, income elasticity, cross elasticity.

Unit – II (10 Hrs.)

Theory of Production: Production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical.

Unit – III (14 Hrs.)

Markets: Meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly). **National Income-** meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP, NDP, Personal income, disposal income.

Unit –IV (10 Hrs.)

Unemployment: Meaning, types, causes, remedies, Inflation- meaning, types, causes, measures to control, Money- meaning, functions, types, Monetary policy and Fiscal policy - meaning, objectives and tools. Human Resource Management- Definitions, objectives of manpower planning, process, sources of recruitment, process of selection.

Recommended Books:

1. R. Paneerselvam, 'Engineering Economics', PHI.
2. N. Gregory Mankiw, 'Principles of Economics', Cengage Learning.
3. L.M. Prasad, 'Principles and Practices of Management'.
4. Subba Reddy, 'Agricultural Economics', Oxford, 2008.
5. Tripathy and Redd, 'Principles of Management'.
6. K.K. Dewett & M.H. Navalur, 'Modern Economic Theory', S. Chand Publications.

SOIL AND WATER CONSERVATION ENGINEERING

Subject Code: BAGE2-412

L T P C

Duration: 44 Hrs.

3 0 0 3

Course Objectives:

Designing soil conservation works, repairing sites of degradation, controlling water retention, water logging and soil salinity and providing advice on water quality and pollution issues. Carrying out environmental impact studies and monitoring construction sites for environmental problems and assessing of irrigation and drainage requirements of soils.

Course Outcomes:

The student will be able to

1. Know about the causes about water scarcity and their solution to fight against the damage effects through soil and water conservation technologies.
2. Recognize different types of erosion, rainfall and runoff.
3. Design and construct a simple earth dam and ponds for farm use,
4. Understand the concept of Universal Soil Loss Equation (USLE) with respect to soil loss.

Unit – I (10 Hrs.)

Introduction: Soil erosion - causes, types and agents of soil erosion; water erosion – forms of water erosion, mechanics of erosion; gullies and their classification, stages of gully development; characteristics of contours and preparation of contour maps.

Unit – II (12 Hrs.)

Erosion Control Measures: Agronomical measures - contour cropping, strip cropping, mulching; mechanical measures - terraces – level and graded broad base terraces and their design, bench terraces & their design, layout procedure, terrace planning, bunds - contour bunds, graded bunds and their design; gully and ravine reclamation.

Unit – III (10 Hrs.)

Wind Erosion: Factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, wind erosion control measures - vegetative, mechanical measures, wind breaks and shelter belts, sand dunes stabilization.

Unit – IV (12 Hrs.)

Soil Loss Estimation: Universal soil loss equation and modified soil loss equation, determination of their various parameters, Sedimentation - sedimentation in reservoirs and streams, estimation and measurement, sediment delivery ratio, trap efficiency.

Design Principle of Channel: Most Economical trapezoidal, introduction to water harvesting techniques; introduction to stream water quality and pollution.

Recommended Books:

1. Michael, 'Principles of Agricultural Engineering', Vol.-2, Jain Brothers, 2013.
2. R. Suresh, 'Soil & Water Conservation Engineering', Standard Publishers Distributors.
3. Ghanshyam Das, 'Hydrology and Soil Conservation Engineering: Including Watershed Management', 2nd Edn., PHI Publication, 2009.
4. V.V.N. Murthy, 'Land and Water Management Engineering', Kalyani Publishers, 2013.
5. R.P. Tripathi and H.P. Singh, 'Soil Erosion and Conservation', 1st Edn., New Age Publishers, 1993.
6. Bimal Chandra Mal, 'Introduction to Soil and Water Conservation Engineering', Kalyani Publishers, 2011.

FARM POWER

Subject Code: BAGE2-413

L T P C
3 1 0 4

Duration: 46 Hrs.

Course Objectives:

This course involves the use, maintenance, adjustment, calibration, and repair of the machines. The selection and operation of machines will be practiced. Safety will be stressed throughout and also Know the different power sources on a farm. In this subject learn the principles of operation of farm equipment.

Course Outcomes:

1. The students will be able to learn about different sources of farm power, construction and ii) functioning of CI and SI engines.
2. Identify all the power sources for farm operations.
3. Introduce students to the available power sources for farm operations.
4. Introduce students to selection and management of farm tractors and implements.

Unit – I (10 Hrs.)

Sources of farm power - conventional & non-conventional energy sources and their utilization, classification of tractors and IC engines, Review of thermodynamic principles of IC (CI &SI) engine and deviation from ideal cycle.

Unit – II (12 Hrs.)

Engine & their components, their construction, operating principles and functions, valves and valve mechanism, Firing order and diagram, criteria for selection. Study of constructional details, adjustments and operating principles of fuel and air supply, cooling, lubricating, ignition, governing and electrical systems.

Unit – III (12 Hrs.)

IC engine fuels - their properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines, Properties of coolants, anti-freeze and anti-corrosion materials, lubricant types & study of their properties.

Unit – IV (12 Hrs.)

Transmission systems of wheel and track type tractors: clutch, gear box, differential and final Drive mechanism PTO system, type, standardization, belt and pulley on tractor and their standardization. Preventive maintenance of various systems.

Recommended Books:

1. Jagdishwar Sahay, 'Elements of Agricultural Engineering', St. Publishers Distributors.
2. John B. Lijjedahal, Paul K. Turnquist, 'Tractors and their Power Units', CBS Publication.
3. S.C. Jain, 'Farm Tractor maintenance and repair,' Standard Publishers Distributors.
4. Donnell Hunt, 'Farm Power and Machinery Management', Medtech, 10th Edn., 2013.
5. Suresh, 'Farm Power and Machinery Engineering', Standard Publishers Distributors.

SURVEYING & LEVELLING LAB.

Subject Code: BAGE2-414

**L T P C
0 0 2 1**

EXPERIMENTS

1. Chain survey of an area and preparation of map
2. Measurement of distance, ranging a line.
3. Compass survey of an area and plotting of compass survey.
4. Contour survey of an area and preparation of contour map.
5. Introduction of software in drawing contour.
6. Plane table survey, different methods of plotting, two point & three-point problem.
7. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
8. To study of different methods of levelling, height of instrument, rise & fall methods.
9. Advancement of Total stations.
10. Measurement of horizontal and vertical angle by theodolite.
11. Determination of height of an inaccessible object.
12. Determination of area of irregular figure by using planimeter.
13. Height of object by using theodolite.
14. Setting out of circular curves in the field using different methods.
15. Determination of tachometric constants and determination of reduced levels by tachometric observations.

THEORY OF MACHINE LAB.

Subject Code: BAGE2-415

**L T P C
0 0 2 1**

EXPERIMENTS

1. To study the various inversions of kinematic chains.
2. Conduct experiments on various types of governors.
3. Demonstration of static and dynamic balancing in the laboratory.
4. Determination of gyroscopic couple (graphical method).
5. Balancing of rotating masses (graphical method).
6. Cam profile analysis (graphical method)
7. Motion analysis of Epicyclical gear trains using tabular and formula methods.
8. Analysis of 4-bar mechanism slides crank mechanism and their inversions.
9. Draw graphs between height and equilibrium speed of a governor.
10. To draw circumferential and axial pressure profile in a full journal bearing.
11. To determine coefficient of friction for a belt-pulley material combination.
12. Determination of moment of inertia of flywheel.
13. To study the flywheel and governor action in laboratory.
14. To study the static and dynamic balancing using rigid blocks
15. To draw displacement, velocity & acceleration diagram of four bar mechanism.

SOIL AND WATER CONSERVATION ENGINEERING LAB.

Subject Code: BAGE2-416

**L T P C
0 0 2 1**

EXPERIMENTS

1. Study of different types of conservation measures.
2. Design of drop spillway.

3. Design of drop inlet spillway.
4. Design of farm pond.
5. Demonstration of Bench Terrace in the farming.
6. Study of USLE/MUSLE parameter.
7. Study about the Contour farming.
8. Determination from nutrient availability in soil.
9. To demonstrate the conservation of tillage.
10. Study of erosion checked by row cropping pattern.
11. Study of contour cropping effect on soil erosion.
12. Study of bund /graded/contour bund.
13. Design of grassed water ways.
14. Computation of soil erosion by USLE/MUSLE.
15. Design of Trapezoidal water ways.

SOFT SKILLS-II

Subject Code: BHUM0-F92

L T P C

0 0 2 1

Course Objectives:

The course aims to address various challenges of communication as well as behavioural skills faced by individual at work place and organisations. Also, it aims to enhance the employability of the students.

Course Outcomes:

At the end of the course the student will be able to understand the importance of goal setting. They will also be able to handle stress in their lives and future in a better way.

UNIT-1

Developing Positive Attitude: Introduction. Formation of attitude. Attitude in workplace. Power of positive attitude. Examples of positive attitudes. Negative attitudes. Examples of negative attitude. overcoming negative attitude and its consequences.

Improving Perception: Introduction. Understanding perception. perception and its application in organizations.

UNIT-2

Career Planning: Introduction. Tips for successful career planning. Goal setting-immediate, short term and long term. Strategies to achieve goals. Myths about choosing career.

UNIT-3

Art of Reading: Introduction. Benefits of reading. Tips for effective reading. the SQ3R technique. Different stages of reading. determining reading rate of students. Activities to increase the reading rate. Problems faced. Becoming an effective reader.

UNIT-4

Stress Management: Introduction. meaning. positive and negative stress. Sources of stress. Case studies. signs of stress. Stress management tips. Teenage stress.

Recommended Books:

1. K. Alex, S. Chand Publishers.
2. Rizvi, M. Ashraf, 'Effective Technical Communication', McGraw Hill.
3. Mohan Krishna & Meera Banerji, 'Developing Communication Skills', Macmillan.
4. Kamin, Maxine, 'Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams & Leaders', Pfeiffer & Amp; Company, Washington, DC, 2013.

AGRICULTURAL STRUCTURE AND ENVIRONMENTAL CONTROL

Subject Code: BAGE2-517

**L T P C
3 0 0 3**

Duration: 44 Hrs.

Course Objectives:

To provide the technical knowledge of structures on the farm and to expose the basic concepts of design.

Course Outcomes:

1. At the end of the course, students will be able to:
2. Study planning and layout of farmstead.
3. Construct and estimate the cost of farm structures.
4. Select the sites and orientation of sanitation buildings.
5. Use of renewable energy sources and environmental control.

Unit - I (10 Hrs.)

Planning and layout of farmstead, Physiological reactions of livestock to solar radiation and other environmental factors, Livestock production facilities, BIS, Standards for dairy, piggery, poultry and other farm structures.

Unit - II (12 Hrs.)

Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc.:. Design and construction of rural grain storage system, Engineering for rural living and development, rural roads, their construction cost and repair and maintenance.

Unit - III (12 Hrs.)

Sources of water supply, Norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community, Site and orientation of building in regard to sanitation, community sanitation system; sewage system its design, cost and maintenance, design of septic tank for small family.

Unit - IV (10 Hrs.)

Estimation of power requirement for domestic and irrigation, source of power supply, use of alternate source of energy, electrification of rural Housing, Scope, importance and need for environmental control, Renewable and non-renewable resources and their equitable use, concept of eco system, biodiversity of its conservation, environmental pollution and their control, solid waste management system, BOD and COD of food plant waste, primary and secondary treatment of food plant waste.

Recommended Books:

1. M.L. Hellickson and J.N. Walker, 'Ventilation of Agricultural Structures'.
2. L.P. Bengtsson, 'Farm Structures in Tropical Climates'.
3. J.H. Whitaker, 'Agricultural Buildings and Structures. National Food & Energy'.
4. R.E. Phillips, 'Farm Buildings: From Planning to Completion'.
5. ASAE, 'Environmental Control for Animals and Plants Textbooks'.
6. J.S. Boyd, 'Practical Farm Buildings', A Textbook & Handbook.

SOIL AND WATER CONSERVATION STRUCTURES

Subject Code: BAGE2-518

**L T P C
3 1 0 4**

Duration: 44 Hrs.

Course Objectives:

This course includes functional requirement and design of soil conservation structures to check soil erosion due to excessive runoff. Site selection and design of farm ponds and cost estimation of these structures.

Course Outcomes:

1. The Students will know about the different types of soil conservation structures.
2. The students will be able to understand the design principle of these structures.
3. Site selection criteria will be useful for application of knowledge in the field problems.

Unit – I (12 Hrs.)

Introduction and classification of structures, Functional requirements of soil erosion control structures. Flow in open channels, types of flow, state and regimes of flow. Concept of Specific energy and specific force. Runoff measuring structures-H flume and Parshall flume.

Unit – II (12 Hrs.)

Hydraulic jump and its application, Energy dissipation due to jump, jump efficiency and relative loss of energy, Runoff measuring structures; General description of straight drop spillway, structural parts and functions, advantages and disadvantages of spillway. Hydrologic and hydraulic design.

Unit - III (10 Hrs.)

Structural design of a drop spillway, Safety against sliding, overturning, crushing and tension, Chute spillway, general description and its components; Hydraulic design, energy dissipaters and design criteria of a SAF stilling basin and its limitations.

Unit –IV (10 Hrs.)

Drop inlet spillway, general description, functional use and design criteria. Design of diversions. Small earth embankments, types and design principles. Maintenance of earthen dams. Farm ponds, site selection and their design and construction. Cost estimation of structures.

Recommended Books:

1. V.V.N. Murty, 'Land and Water Management Engineering', Kalyani Publication.
2. R. Suresh, 'Soil and Water Conservation Engineering', Standard Publishers, Distributors.
3. Ghanshyam Das, 'Hydrology and Soil Conservation Engineering', PHI Learning Private Ltd.

DAIRY AND FOOD ENGINEERING

Subject Code: BAGE2-519

**L T P C
2 1 0 3**

Duration: 40 Hrs.

Course Objectives:

This course helps the students to gain a good knowledge on the various processes and equipment used in the processing of milk and milk products. To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products, sanitation and effluent treatment in dairy industry.

Course Outcomes:

1. The students will gain knowledge about Dairy and Food process engineering
2. Students will understand the importance of quality control and food preservation and packaging.
3. To expose the students to the fundamental knowledge of food, its properties and different methods of food processing.

Unit - I (10 Hrs.)

Dairy development in India. Engineering, chemical and thermal properties of milk and milk products (In brief), Composition and proximate analysis of food products.

Unit - II (10 Hrs.)

Unit operation of various dairy and food processing systems, process flow charts for product manufacture, Deterioration in products and their controls.

Unit - III (10 Hrs.)

Working principles of equipment for receiving, pasteurization, sterilization, homogenization, filling & packaging (Production of butter, Panner & Cheese) dairy plant design and layout,

composition and proximate analysis of food products. Determination in products and their controls.

Unit - IV (10 Hrs.)

Physical, chemical and biological methods of food preservation, changes during processing, evaporation, drying, freezing juice extraction, filtration, membrane separation, thermal processing, plant utilities requirement.

Recommended Books:

1. Sharma, 'Dairy Science and Technology and Food and Dairy Engineering', 1st Edn., CBS, 2009.
2. J.G. Brennan, Butters, Jr. N.D. Cowell and A.E.V. Lilly, 'Food Engineering Operations', Applied Science Publishers, 1976.
3. A.W. Farrall, 'Engineering for Dairy and Food Products', Wiley Eastern Pvt. Ltd., New Delhi, 1967.
4. H.G. Kessler, 'Food Engineering and Dairy Technology', V.A. Kessler, Freising, Germany, 1981.
5. Tufail Ahmad, 'Dairy Plant Engineering and Management', Kitab Mahal, 2003.

TRACTOR SYSTEMS, CONTROL & OPERATION

Subject Code: BAGE2-520

L T P C

Duration: 44 Hrs.

3 1 0 4

Course Objectives:

To provide the technical knowledge of various tractor systems and their Control and operations of farm machinery.

Course Outcomes:

1. At the end of the course, students will be able to know about various tractor systems
2. Students will understand the control and operation of different mechanisms used in tractor and farm implements to perform different tasks.
3. To expose the students to the fundamental knowledge of different components of tractor and implements

Unit- I (10 Hrs.)

Study of transmission systems, clutch, gear box, differential and final drive mechanism. Familiarization of brake mechanism. Ackerman and hydraulic steering and hydraulic systems.

Unit-II (8 Hrs.)

Tractor power outlets: P.T.O., belt pulley, drawbar, etc. Tractor chassis mechanics and design for tractor stability.

Unit-III (10 Hrs.)

Ergonomic considerations and operational safety, Introduction to tractor maintenance procedure and trouble shooting. Scheduled maintenance after 10, 50, 100, 250, 500 and 1000 Hrs. of operation. Safety hints.

Unit-IV (12 Hrs.)

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 and workshop requirements.

Recommended Books:

1. F.R. Jones, 'Farm Gas Engines and Tractors'.
2. E.L. Barger, Lijedehl, W.B. Carleton and E.G. Mc Kibben, 'Tractors and their Power Units'.
3. Radhey Lal and Dutta, 'Agricultural Engineering through solved examples'.
4. Irving Frazeee and V.E. Philip, 'Tractors and Crawlers'.

SOIL AND WATER CONSERVATION STRUCTURES LAB.

Subject Code: BAGE2-521

L T P C

0 0 2 1

EXPERIMENTS

1. Study of different parts of H-flume and Parshall flume.
2. Construction of specific energy and specific force diagram.
3. Measurement of hydraulic jump parameters and amount of energy dissipation.
4. Design of drop spillway.
5. Stability analysis of drop spillway
6. Design of Chute spillway.
7. Design of drop inlet spillway.
8. Design of small earthen embankments.
9. Design of a SAF energy dissipater.
10. Design of water harvesting structures.
11. Cost estimation of structures.
12. Visit to a watershed to understand the runoff pattern.

TRACTOR SYSTEMS, CONTROL & OPERATION LAB.

Subject Code: BAGE2-522

L T P C

0 0 2 1

EXPERIMENTS

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

DAIRY AND FOOD ENGINEERING LAB.

Subject Code: BAGE2-523

L T P C

0 0 2 1

EXPERIMENTS

1. Study of a composite pilot milk processing plant & equipment
2. Study of pasteurisers
3. Study of sterilizers
4. Study of homogenisers
5. Study of separators
6. Study of butter churners
7. Study of evaporators
8. Study of milk dryers
9. Study of freezers

10. Design of food processing plants & preparation of layout
11. Visit to multiproduct dairy product
12. Determination of physical properties of food products
13. Estimation of steam requirements
14. Estimation of refrigeration requirements in dairy & food plant
15. Visit to Food industry

ENGINEERING HYDROLOGY

Subject Code: BAGE2-625

L T P C
2 1 0 3

Duration: 40 Hrs.

Course objectives:

The knowledge of hydrology is prerequisite for the irrigation engineering and also for design of hydraulic structure. So one of the objective of this course is to impart the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth.

Course Outcomes:

1. Students shall learn various components of hydrologic cycle that affect the movement of water in the earth.
2. Students can compute hydrologic mass balance in a closed basin.
3. Students can develop unit hydrographs based on stream flow data, and conduct basic unit hydrograph analysis.
4. Students understand basic concepts of hydrologic simulation modelling.

Unit – I (10 Hrs.)

Introduction: Hydrologic cycle; precipitation - forms, rainfall measurement, mass curve, hydrograph, mean rainfall depth, plotting position, estimation of missing data, test for consistency of rainfall records; interception infiltration; evaporation; evapo-transpiration estimation and measurement.

Unit – II (10 Hrs.)

Runoff: Factors affecting, measurement; stage and velocity, rating curve, extension of rating curve; estimation of peak runoff rate and volume; rational method, Cook's method, SCS method, Curve number method. Geomorphology of watersheds – stream number, stream length, stream area, stream slope.

Unit – III (8 Hrs.)

Hydrograph: Components, base flow separation, unit hydrograph theory, Unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph.

Unit – IV (12 Hrs.)

Head Water Flood Control: Methods, retards and their location; flood routing – graphical methods of reservoir flood routing, Muskingum method of flood routing; hydrology of dry land areas - drought and its classification; Introduction to watershed management and planning, Horton's laws.

Recommended Books & References:

1. Rajesh Srivastava, Ashu Jain, 'Engineering Hydrology', 1st Edn., McGraw Higher Ed., 2017.
2. V.V.N. Murty, 'Land and Water Management Engineering', Kalyani Publication.
3. K. Subramanya, 'Engineering Hydrology', McGraw Higher Ed. Publication, 2013.
4. S.K. Garg, 'Water Resource Engineering and Hydrology', 1st Edn., K.H. Publications, 2010.
5. Engineers Zone Publications, 'Hydrology & Irrigation Engineering, 1st Edn., Engineers Zone Publications, 2016.

ENGINEERING PROPERTIES OF BIOLOGICAL MATERIAL & FOOD QUALITY

Subject Code: BAGE2-626

L T P C
3 1 0 4

Duration: 47 Hrs.

Course Objectives:

This course gives an insight into the properties of different food materials and their quality standards. The objective of this course is to make the students understand the basic properties of food materials and enable them to process, preserve and use them for various applications.

Course Outcomes:

At the end of the course, students will be able to:

1. Describe the importance of engineering properties of biological materials.
2. Explain different physical and thermal characteristics of important biological materials.
3. Discuss the concept, need and objectives of quality control.
4. Apply different types of quality control processes.

Unit – I (8 Hrs.)

Importance of engineering properties of biological materials, Physical properties like shape, size, volume, density, roundness, sphericity, surface area.

Unit – II (10 Hrs.)

Thermal properties like thermal conductivity, specific heat & thermal diffusivity measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition.

Unit – III (12 Hrs.)

Rheological characteristics like stress, strain time effects, rheological models and their equations, Aerodynamic characteristics and fractional properties of biological materials, Application of engineering properties in handling processing machines and storage structure.

Unit – IV (10 Hrs.)

Objectives and need of food quality; Measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition; Sampling; purpose, sampling techniques, sampling procedures for liquid, powdered and granular materials.

Recommended Books & References:

1. O.P. Singhal and D.V.K. Samuel, 'Engineering Properties of Biological Materials', Saroj Prakashan, Allahabad, 2003.
2. N.N. Mohenensin, 'Physical Properties of Plant and Animal Materials', Routledge Publication.
3. M.A. Rao and S.S.H. Rizvi, 'Engineering Properties of Foods', 4th Edn., CRC Press, 2014.
4. B. Hallstrom, H.F. Meffert, Th., W.E.L. Speiss, 'Physical Properties of Food'.
5. S. Sahin, & S.G. Summu, 'Physical Properties of Foods', New York: Springer, 2006.

DRAINAGE ENGINEERING

Subject Code: BAGE2-627

L T P C
3 1 0 4

Duration: 47 Hrs.

Course Objectives:

The understanding of various drainage techniques is useful for reclamation for water logged area for crop production.

Course Outcomes:

At the end of the course, students will be able to:

1. To understand the different types of drainage systems.
2. To apply suitable engineering techniques for reclamation of the agricultural lands suffering from water logging.

3. To understand conjunctive use of water resources for solutions to drainage problem on agricultural soils.

Unit – I (8 Hrs.)

Drainage, objectives of drainage, familiarization with the drainage problems of the state, Surface drainage, drainage coefficient, types of surface drainage.

Unit – II (10 Hrs.)

Subsurface drainage purpose and benefits, investigations of design parameters, hydraulic conductivity, drainable porosity, water table, drainage criteria, types and use of subsurface drainage system.

Unit – III (12 Hrs.)

Design of surface drains, interceptor and relief drains, Derivation of ellipse (Hooghoudt's) and Ernst's drain spacing equations. Steady and unsteady state groundwater condition, dynamic equilibrium concept, Design of subsurface drainage system. Drainage materials, drainage pipes, drain envelope, Layout construction and installation of drains.

Unit – IV (10 Hrs.)

Drainage Structures: Vertical drainage. Bio-drainage, Tile Drains; Drainage of irrigated and humid areas; Salt balance, reclamation of saline and alkaline soils; Leaching requirements, Conjunctive use of fresh and saline waters; Economic aspects of drainage.

Recommended Books & References:

1. J.N. Luthin, 'Drainage Engineering', Wiley Eastern Pvt. Ltd. New Delhi.
2. R.T. Thokal, Sunil Gorantiwar, A.G, Powar, 'Agricultural Drainage: Principles & Practices', 1st Edn., Westville Publishing House, New Delhi.
3. A.M. Michael and T.P. Ojha, 'Principles of Agricultural Engineering', Vol.-II, 5th Edn., Jain Brothers, 2018.

HANDS ON TRAINING IN CAD/CAM

Subject Code: BAGE2-628

**L T P C
3 0 0 3**

Duration: 40 Hrs.

Course Objectives:

Learn how to integrate Design and Manufacturing Systems through incorporation of computers.

Course Outcomes:

Upon completion of the course, students shall be able to:

1. Understand use of computers in design and manufacturing systems.
2. Know about computerized manufacturing methods.
3. Select suitable manufacturing method for complex components.
4. Acquire the Knowledge of data bases, software s and hardware's for computer design in organization.

Unit - I (8 Hrs.)

First and third angle methods of projection, Preparation of working drawings from models and isometric views Drawing of missing views and different methods of dimensioning Concept of sections, revolved and oblique sections Sectional drawing of simple machine parts.

Unit - II (10 Hrs.)

Types of rivet heads and riveted joints, process of producing leak proof joints Threads nomenclature, profiles, mull start, left and right hand and conventional representation of threads Nuts and bolts- square headed, hexagonal, types of lock nuts, studs, machine screws, cap screw and wood screw, foundation bolts.

Unit - III (12 Hrs.)

Application of computers for design CAD, define, benefits, system components and computer hardware for CAD, display, input and output devices Graphic primitives, display file, frame buffer, display control, display processors, line generation, graphics software; Points and lines,

polygons, filing of polygons, text primitive, windowing and clipping, view port Homogeneous coordinates, transformations, planners and space curves design.

Unit - IV (10 Hrs.)

Introduction to solid modelling, introduction to numeric control, basic components of NC system, NC coordinate and motion control system Computer numerical control, direct numerical control, combined CNC /DNC NC machine tools and control units, tooling for NC machines, part programming, punched tape coding and format, Manual and computer assisted programming.

Recommended Books & References:

1. M. Groover, E. Zimmers, 'CAD/CAM: Computer-Aided Design and Manufacturing', 1st Edn., Pearson Publisher, 2013.
2. P. N. Rao CAD/CAM, 'Principles and Applications', 3rd Edn. 'McGraw Higher Publication, 2010.
3. Hearn, 'Computer Graphics, C Version', 2nd Edn., Pearson Education India, 2002.
4. Alison Beazley, 'Computer-Aided Pattern Design and Product Development', Wiley India Pvt. Ltd., 2011.

ENGINEERING HYDROLOGY LAB.

Subject Code: BTAG-629

L T P C

0 0 2 1

EXPERIMENTS

1. Study and use of anemometer.
2. Study and use of evaporimeters.
3. Study and use of hygrometer.
4. Study and use of sunshine recorder.
5. Study and use of solar radiation instruments.
6. Measurement of precipitation by rain gauges.
7. Analysis of rainfall data.
8. Study of stream gauging instruments and measurement.
9. Development of hydrograph.
10. Run-off- computations.
11. Graphical analysis of flood routing.
12. Study of stage recorders and current meters.
13. Exercises on flood routing problems.

**ENGINEERING PROPERTIES OF BIOLOGICAL MATERIAL & FOOD QUALITY
LAB.**

Subject Code: BTAG-630

L T P C

0 0 2 1

EXPERIMENTS

1. Determination of shape & size of agricultural Products.
2. Determination of volume and density.
3. Measurement of roundness.
4. Measurement of sphericity.
5. Determination of surface area of leaf.
6. Determination of thermal conductivity & thermal diffusivity.
7. Measurement of internal friction of product.
8. Measurement of viscosity of jam and jelly.
9. Measurement of texture of biscuits & confectionary.

10. Estimation of sulphur dioxide in foods.
11. Measurement of angle of repose and internal friction.
12. Determination of protein and carbohydrates in a given food sample.
13. Estimation of vitamin C in any food sample.

DRAINAGE ENGINEERING LAB.

Subject Code: BAGE2-631

L T P C

0 0 2 1

EXPERIMENTS

1. Determination of drainage coefficients.
2. In-situ measurement of hydraulic conductivity by inverse auger hole method.
3. In-situ measurement of hydraulic conductivity by single auger hole method.
4. Installation of piezometer and observation well.
5. Preparation of iso- bath and isobar maps.
6. Determination of drainable porosity.
7. Fabrication and testing of drainage tiles.
8. Design of surface drainage systems.
9. Design of subsurface drainage systems.
10. Determination of chemical properties of soil and water (EC, pH, ESP or SAR).
11. Cost analysis of surface and sub-surface drainage system.
12. Visit to subsurface drainage project and drainage material manufacturing industry.

SOFT SKILLS-IV

Subject Code: BHUM0-F94

L T P C

0 0 2 1

Duration: 25 Hrs.

UNIT-1

Art of Speaking: Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

Group Discussion: Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Nonverbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

Preparing Cv/Resume: Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

Interview Skills: Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

Recommended Books:

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., 2014.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, 1998.

4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, 2004.
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1985.

GROUNDWATER, WELLS & PUMPS

Subject Code: BAGE2-732

L T P C
3 1 0 4

Duration: 40 Hrs.

Course Objectives:

1. To acquaint and equip the students with the occurrence, development and hydraulics of ground water flow.
2. To understand the theories and application of wells and pumps.
3. To impart knowledge in areas of water supply and groundwater development.

Course Outcomes:

1. Students know the technical aspects of groundwater, its availability, assessment and utilization
2. Familiarized with the theory behind well design, construction and management of wells.
3. To enable the students to know about the ground water potential, its dynamic behaviour and exploration manual and mechanically.

UNIT- I (10 Hrs.)

Occurrence and Movement of Ground Water: Aquifer and its types, Classification of wells. Steady and transient flow into partially, fully and open wells. Design of open well.

UNIT- II (10 Hrs.)

Groundwater Exploration Techniques: Design, construction and development of tube-wells. Determination of aquifer parameters. Well interference. Multiple well systems. Surface and subsurface exploitation and estimation of ground water potential. Quality of ground water.

UNIT- III (8 Hrs.)

Artificial groundwater recharge planning and modelling. Ground water project formulation.

UNIT- IV (12 Hrs.)

Water Lifting Devices: Types of pump. Design principles, performance curves and selection of centrifugal, submersible, turbine and propeller pumps. Selection of prime mover and pulleys. Trouble shooting in pumping sets. Priming and self-priming devices. Positive displacement pumps and Hydraulic ram.

Recommended Books:

1. H.M. Reghunath, 'Ground Water', Wiley Eastern Ltd., 2003.
2. A.M. Michael, S.D. Khepar and S.K. Sondhi., 'Water Well and Pumps', 2nd Edn., Tata McGraw Hill, 2008.
3. A.M. Michael and T.P. Ojha, 'Principles of Agricultural Engineering', Vol-II, 5th Edn., Jain Brothers Publication, New Delhi, 2014.
4. Todd David Keith and Larry W. Mays., 'Groundwater Hydrology', 3rd Edn., John Wiley & Sons, New York, 2004.

MICRO IRRIGATION SYSTEMS & DESIGN

Subject Code: BAGE2-733

L T P C
2 1 0 3

Duration: 40 Hrs.

Course Objectives:

1. To introduce the concept of micro – irrigation.
2. To design Sprinkler and Drip irrigation systems.

Course Outcomes:

On completing the course, the student should be able to:

1. Design irrigation systems of various types.

2. Plan and operate existing systems.

UNIT- I (10 Hrs.)

Present and future need of micro-irrigation systems. Role of Govt. for the promotion of micro-irrigation in India. Merits, demerits and types of micro-irrigation system.

UNIT- II (10 Hrs.)

Micro-irrigation system- design, design synthesis, installation, and maintenance. Sprinkler irrigation - types, planning factors, uniformity, hydraulics, lateral, sub-mains and main line design.

UNIT- III (8 Hrs.)

Pump and power unit selection. Drip irrigation - potential, automation and crops suitability. Fertigation- Fertilizer application criteria, suitability of fertilizer compounds, fertilizer mixing, injection duration, rate and frequency and capacity of fertilizer tank.

UNIT- IV (12 Hrs.)

Quality control in micro-irrigation components. Design and maintenance of poly-house. Waste land development - hills, semi-arid, coastal areas and water scarce areas. Benefit and Cost analysis.

Recommended Books:

1. M.L. Choudhary and U.S. Kadam, 'Micro Irrigation for Cash Crops', Westville Publishing House, 2006.
2. M.S. Mane and B.L. Ayare and S.S. Magar, 'Principles of Drip Irrigation Systems', Jain Brothers, New Delhi, 2006.
3. A.M. Michael, 'Irrigation: Theory and Practice', Vikas Publishing House, New Delhi, 2012.
4. R. Suresh, 'Principles of Micro-Irrigation Engineering', Standard Publishers Distributors, New Delhi, 2010.

FOOD PROCESSING PLANT DESIGN & LAYOUT

Subject Code: BAGE2- 734

**L T P C
3 1 0 4**

Duration: 40 Hrs.

Course Objectives:

Understanding the fundamental aspects of food processing plant design and their layout.

Course Outcomes:

At the end of the course the student:

1. Will have problem evaluation and problem solving skills regarding food processing operations that can affect the quality of foods.
2. Will be able to apply scientific principles in solving food processing problems and improving product quality and safety.
3. Will be able to know and implement good manufacturing practices.
4. Will have developed long-life learning skills, and communication skills.
5. Will be able to know about of design and layout of food plant.

UNIT- I (12 Hrs.)

Meaning and definition of plant layout, Objectives and principles of Layout, Types of layout; Plant installation, power and power transmission, sanitation; Cost analysis, preparation of feasibility report.

UNIT- II (10 Hrs.)

Salient features of processing plants for cereals, pulses oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products.

UNIT- III (8 Hrs.)

Location selection criteria, selection of processes, plant capacity, project design, flow diagrams.

UNIT- IV (10 Hrs.)

Selection of equipment, process and controls, handling equipment, plant layout, Plant elevation, requirement of plant building and its components, labour requirement.

Recommended Books:

1. Jasim Ahmed and Mohammad Shafiur Rahman, 'Handbook of Food Process Design Vol-2', 1st Edn., Wiley Blackwell, 2012.
2. 'Handbook of Agricultural Engg.', ICAR, New Delhi, 2012.
3. Antonio Lopez-Gomez, Gustavo V. Barbosa, 'Food Plant Design', 1st Edn., CRC Press, 2005.

GROUNDWATER, WELLS & PUMPS LAB.

Subject Code: BAGE2-735

L T P C
0 0 2 1

EXPERIMENTS

1. Verification of Darcy's Law.
2. Analysis of Aquifer material and Design of Gravel pack.
3. Determination of specific yield and specific retention.
4. Study of various type of well screens.
5. Drilling of a tube-well and preparation of well log.
6. Study of draw down and recuperation in pumped well.
7. Estimation of aquifer parameters.
8. Study of artificial ground water recharge structures.
9. Study of positive displacements and centrifugal pumps.
10. Study and testing of submersible pump.

MICRO IRRIGATION SYSTEMS & DESIGN LAB.

Subject Code: BAGE2-736

L T P C
0 0 2 1

EXPERIMENTS

1. Study of different types of micro-irrigation systems.
2. Field visit of micro-irrigation system. Water filtration unit.
3. Discharge measurement study of different micro-irrigation systems.
4. Water distribution and uniformity coefficient.
5. Wetted front and moisture distribution.
6. Design of micro-irrigation system for an orchard and row crops.
7. Automation in micro- irrigation system.
8. Micro climate inside a poly-house.
9. Study of maintenance and cleaning of different components of various systems.
10. Design of sprinkler and landscape irrigation system.

CROP PROCESS ENGINEERING

Subject Code: BTAG2- 839

L T P C
3 1 0 4

Duration: 38 Hrs.

UNIT- I (8 Hrs.)

Scope and importance of food processing, principles and methods of food processing. Processing of farm crops; cereals, pulses, oil seeds, fruits and vegetables and their products for food and feed, Processing of animal products.

UNIT- II (10 Hrs.)

Principle of size reduction, grain shape, Size reduction machines; crushers, grinders, cutting machines operation, efficiency and power requirement – Rittinger's, Kick's and Bond's equation, fineness modulus.

UNIT- III (10 Hrs.)

Types of separators, size of screens, sieve analysis, capacity and effectiveness of screens, pneumatic separation. Theory of filtration, study of different types of filters, rate of filtration, pressure drop during filtration.

UNIT- IV (10 Hrs.)

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.

Recommended Books:

1. K.M. Sahay, and K.K. Singh, 'Unit operations of Agricultural Processing', Vikas Publishing House Pvt. Ltd., New Delhi, 1994.
2. Suresh Chandra, Durvesh Kumari, 'Crop Process Engineering', 1st Edn., Jain Brothers, 2018.
3. P.H. Pandey, 'Principles of Agriculture Processing', Kalyani Publishers, Ludhiana, 1994.

WATERSHED PLANNING AND MANAGEMENT

Subject Code: BAGE2- 840

L T P C

Duration: 40 Hrs.

2 1 0 3

Course Objectives:

To discuss different aspects of water resource development and management on watershed basis. To develop skills to analyse various complex problems of watershed using typing watershed modelling techniques for rainfall runoff and soil erosion. To understand sustainable watershed approach for water quality management, storm water management, flood management and drought management.

Course Outcomes:

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

UNIT- I (10 Hrs.)

Watershed Management: Problems and prospects, watershed based land use planning, watershed characteristics, physical and geomorphologic, factors affecting watershed management, hydrologic data for watershed planning.

UNIT- II (12 Hrs.)

Watershed Delineation: Delineation of priority watershed, water yield assessment and measurement from a watershed; hydrologic and hydraulic design of earthen embankments and diversion structures, Micro-catchments farming, Irrigation with saline water, Hi-tech irrigation methods, Reducing water losses, Forestry, Rain water management.

UNIT- III (10 Hrs.)

Sediment yield estimation and measurement from a watershed and sediment yield models; rainwater conservation technologies - in-situ and storage, design of water harvesting tanks and ponds; water budgeting in a watershed; effect of cropping system.

UNIT- IV (8 Hrs.)

Land management and cultural practices on watershed hydrology; evaluation and monitoring of watershed programmes; people's participation in watershed management programmes. Dry land farming, techniques based on watershed characteristics.

Recommended Books:

1. N.V.V. Dhruva, G. Sastry and U.S. Patnaik, 'Watershed Management', Indian Council of Agricultural Research, New Delhi, 1990.
2. R. Suresh, 'Soil and Water Conservation Engineering', Standard Publishers Distributors, New Delhi, 2002.
3. J.V.S. Murty, 'Watershed Management', 2nd Edn., New Age International Publishers, New Delhi, 2004.
4. K.V.S. Rao, 'Watersheds: Comprehensive Development', B.S. Publications, Hyderabad, 2003.
5. G. Singh, C. Venkataraman, G. Sastry and B.P. Joshi, 'Manual of Soil and Water Conservation Practices', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1990.

CROP PROCESS ENGINEERING LAB.

Subject Code: BTAG-841

L T P C

0 0 2 1

EXPERIMENTS

1. Preparation of flow and layout charts of a food processing plant
2. Determination of fineness modulus and uniformity index
3. Performance evaluation of hammer mill
4. Performance evaluation of attrition mill
5. Study of cleaning equipment
6. Separation behaviour in pneumatic separation
7. Study of grading equipment
8. Evaluation of performance of indented cylinder and screen pre-cleaner
9. Mixing index and study of mixers
10. Study of conveying equipment
11. Performance evaluation of bucket elevator.

WATERSHED PLANNING AND MANAGEMENT LAB.

Subject Code: BAGE2-842

L T P C

0 0 2 1

EXPERIMENTS

1. Exercises on delineation of watersheds using toposheets.
2. Surveying and preparation of watershed map.
3. Quantitative analysis of watershed characteristics and parameters.
4. Watershed investigations for planning and development.
5. Analysis of hydrologic data for planning watershed management.
6. Water budgeting of watersheds.
7. Prioritization of watersheds based on sediment yield index.
8. Study of functional requirement of watershed development structures.
9. Study of watershed management technologies.
10. Practice on software's for analysis of hydrologic parameters of watershed.
11. Study of role of various functionaries in watershed development programmes.
12. Techno-economic viability analysis of watershed projects. Visit to watershed development project areas.