Integral University, Lucknow
Integral Institute of Agricultural Science and Technology
Evaluation Scheme of Undergraduate program
B. Tech. Agricultural Engineering
w.e.f. Session 2017-18

Semester - III

Course Code	Subject	Periods Per h/week/sem			Evaluation Scheme Theory Mid sem			Evaluation Scheme Practical Examination					End sem Theory Exam	Subject total	Credit	Total Credit Points
								Sessional			End sem exam (Taken by external examiner)	Sub Total (sessional + exam)[b+c]				
		L	T	P	CT	TA	Total[a]	CT	TA	Total[b]	Total[c]					
AE230	**Engineering Mechanics**	2	0	2	10	10	**20**	5	5	10	20	**30**	**50**	**100**	2:0:1	3
BE261	**Engineering Properties of Biological Materials and Food Quality**	2	0	2	10	10	**20**	5	5	10	20	**30**	**50**	**100**	2:0:1	3
AE231	**Soil Mechanics**	2	0	2	10	10	**20**	5	5	10	20	**30**	**50**	**100**	2:0:1	3
AE232	**Soil and Water Conservation Engineering**	2	0	2	10	10	**20**	5	5	10	20	**30**	**50**	**100**	2:0:1	3
AE233	**Farm Machinery and Equipment-I**	2	0	2	10	10	**20**	5	5	10	20	**30**	**50**	**100**	2:0:1	3
AE234	**Farm Power**	2	0	2	10	10	**20**	5	5	10	20	**30**	**50**	**100**	2:0:1	3
AE235	**Watershed Hydrology**	2	0	2	10	10	**20**	5	5	10	20	**30**	**50**	**100**	2:0:1	3
MT215	**Engineering Mathematics in Agriculture-III**	3	0	0	10	10	**20**	-	-	-	-	**-**	**80**	**100**	3:0:0	3
	Total	**17**		**14**												**24**

[a] **Theory mid sem (20 marks)** = Mid sem/makeup (10 marks) + Quiz 1 (2.5 marks) + Quiz 2 (2.5 marks) + Attendance (5 marks)

[b] **Practical mid sem (10 marks)** = CT (5 marks) + TA (2.5 marks) + Attendance (2.5 marks)

[c] **End sem exam practical (Taken by external examiner)** = 20 marks

End sem final theory = 100 marks (40 marks objective type and 60 marks subjective type questions)

B. Tech. Agricultural Engineering

SEMESTER-III

Syllabus: Engineering Mechanics

Paper Code: AE230

w.e.f. Session 2017-18

3 (2+1)

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

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

B. Tech. Agricultural Engineering

SEMESTER-III

Syllabus: Engineering Properties of Biological Materials and Food Quality

Paper Code: BE261

w.e.f. Session 2017-18

3 (2+1)

Importance of engineering properties of biological materials, Study of different physical and thermal characteristics of important biological materials like shape, size, volume, density, roundness, sphericity, surface area, specific heat, thermal conductivity, thermal diffusivity, etc. measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition. Rheological characteristics like stress, strain time effects, rheological models and their equations. Aerodynamic characteristics and frictional properties. Application of engineering properties in handling processing machines and storage structures. Concept, objectives and need of quality, quality control, methods of quality control, sampling; purpose, sampling techniques, requirements and sampling procedures for liquid, powdered and granular materials, sensory quality control, panel selection methods, interpretation of sensory results in statistical quality control, TQM and TQC, consumer preferences and acceptance, Food Laws and Regulations in India. Food grades and standards BIS, AGMARK, PFA, FPO, CAC (Codex Alimentarius Commission), sanitation in food industry, GMP, HACCP (Hazard analysis and critical control point) and ISO 9000 Series.

Practical: To find the shape and size of grains and fruits and vegetables. To determine bulk density and angle of repose of grains. To determine the particle density/true density and porosity of solid grains. To find out the co-efficient of external and internal friction of different crops; To study the separating behaviour of a grain sample in a vertical wind tunner (Aspirator column). To find the thermal conductivity of different grains. To determine specific heat of some food grains. To determine cooking quality of rice. To determine impurities and invisible stress cracks in grains. Preparation of a ready reckoner of change in unit weight of food grains as affected by change in its moisture content (w.b.) (5% - 25%). Milling quality of paddy; Determination of hardness of food material; Detection of adulteration in food products *viz*. milk, ghee, honey etc.

B. Tech. Agricultural Engineering

SEMESTER-III

Syllabus: Soil Mechanics

Paper Code: AE231

w.e.f. Session 2017-18

3 (2+1)

Introduction of soil mechanics, field of soil mechanics, phase diagram physical and index properties of soil classification of soils, general classification based on particles size, textural classification and I.S. soil classification system stress condition in soils, effective and neutral stress, elementary concept of Bousinesque and Wester guards analysis, newmark influence chart. 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 perameters by direct shear to be circle, theoretical test. Numerical exercise based on various types of tests. Compaction composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction text field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory Laboratory consolidation text, calculation of void ratio and coefficient of volume change, Taylor's and Casagrand's method, determination of coefficient of consolidation. Earth pressure: Plastic equilibrium in soils, active and passive states, Rankine's theory of earth pressure active and passive earth pressure for cohesive soils, simple numerical exercise. Stability of slopes: Introduction to stability analysis of infinite and finite slopes friction circles method Taylor's stability number.

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

B. Tech. Agricultural Engineering

SEMESTER-III

Syllabus: Soil and Water Conservation Engineering

Paper Code: AE232

w.e.f. Session 2017-18

3 (2+1)

Introduction; classification of structures, functional requirements of soil erosion control structures; flow in open channels-types of flow, state of flow, regimes of flow, energy and momentum principles, specific energy and specific force; hydraulic jump and its application, type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy; runoff measuring structures-parshall flume, H - flume and weirs; straight drop spillway - general description, functional use, advantages and disadvantages, structural parts and functions; components of spillway, hydrologic and hydraulic design, free board and wave free board, aeration of weirs, concept of free and submerged flow, structural design of a drop spillway-loads on headwall, variables affecting equivalent fluid pressure, determination of saturation line for different flow conditions, seepage under the structure, equivalent fluid pressure of triangular load diagram for various flow conditions, creep line theory, uplift pressure estimation, safety against sliding, over turning, crushing and tension; chute spill way general description and its components, hydraulic design, energy dissipaters, design criteria of a SAF stilling basin and its limitations, drop inlet spillway- general description, functional use, design criteria; design of diversions; small earth embankments-their types and design principles, farm ponds and reservoirs, cost estimation of structures.

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

B. Tech. Agricultural Engineering

SEMESTER-III

Syllabus: Farm Machinery and Equipment-I

Paper Code: AE233

w.e.f. Session 2017-18

3 (2+1)

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. Tillage; primary and secondary tillage equipment. Forces acting on tillage tools. Hitching systems and controls. Draft measurement of tillage equipment: Earth moving equipment - their construction and working principles *viz* Bulldozer, Trencher, Elevators etc.; sowing, planting and transplanting equipment – their calibration and adjustments. Fertilizer application equipment. Weed control and Plant protection equipment - sprayers and dusters, their calibration, selection, constructional features of different components and adjustments.

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

B. Tech. Agricultural Engineering

SEMESTER-III

Syllabus: Farm Power

Paper Code: AE234

w.e.f. Session 2017-18

3 (2+1)

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

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

B. Tech. Agricultural Engineering

SEMESTER-III

Syllabus: Watershed Hydrology

Paper Code: AE235

w.e.f. Session 2017-18

3 (2+1)

Introduction; hydrologic cycle; precipitation-forms, rainfall measurement, mass curve, hydrograph, mean rainfall depth, frequency analysis of point rainfall, plotting position, estimation of missing data, test for consistency of rainfall records; interception; infiltration; evaporation; evapo-transpiration-estimation and measurement; geomorphology of watersheds-stream number, stream length, stream area, stream slope and Horton's laws; runoff-factors affecting, measurement; stage and velocity, rating curve, extension of rating curve; estimation of peak runoff rate and volume; rational method, Cook's method, SCS method, Curve number method; hydrograph; components, base flow separation, unit hydrograph theory-unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph; head water flood control - methods, retards and their location; flood routing –graphical methods of reservoir flood routing; hydrology of dry land areas-drought and its classification; introduction to watershed management and planning.

Practical: Visit to meteorological observatory; Study of different types of rain gauges; Exercise on analysis of rainfall data; Double mass curve technique; Determination of average depth of rainfall and frequency analysis; Study of stage recorders and current meters; Exercise on estimation of peak runoff rate and runoff volume; Exercises on hydrograph and unit hydrograph; Exercises on design and location of retards for channel improvement; Exercises on flood routing problems.

B. Tech. Agricultural Engineering

SEMESTER-III

Syllabus: Engineering Mathematics in Agriculture-III

Paper Code: MT215

w.e.f. Session 2017-18

3 (3+0)

Numerical analysis: Finite differences, various difference operators and their relationships, factorial notation, interpolation with equal intervals, Newton's forward and backward interpolation formulae, Bessel's and Stirling's central difference interpolation formulae, interpolation with unequal intervals, Newton's divided difference formula, Lagrange's interpolation formula; numerical differentiation, differentiation based on equal interval interpolation, first and second order derivatives by using Newton's forward and backward, Stirling's and Bessel's formulae; maxima and minima of a tabulated function, numerical integration, numerical integration by Trapezoidal, Simpson's and Weddle's rules; Difference equations, order of a difference equation, solution of linear difference equation, rules for finding complimentary function and particular integral; numerical solution of ordinary differential equations by Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta method. Laplace transforms: Definition of Laplace transform, Laplace transforms of elementary functions, properties of Laplace transforms, inverse Laplace transforms, transforms of derivatives, integrals, transform of function multiplied by t^n, transform of function divided by t, convolution theorem; application of Laplace transforms to solve ordinary differential equations and simultaneous differential equations, Laplace, transforms of unit step function, unit impulse function, periodic function.