Faculty of Engineering &Technology
P.K. University
Shivpuri (MP)

Department of Agriculture Engineering

Evaluation Scheme & Syllabus of
B.Tech -AG
Second Year III & IV Semester

(Effective from session 2025-26)

EVALUATION SCHEME
B.TECH - AGRICULTURE ENGINEERING(3rdSem)

STUDY AND EVALUATION SCHEME FOR B.TECH IN AGRICULTURE ENGINEERING
YEAR 2nd/SEMESTER-III

SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
UENGIAE301	ENGINEERING MATHEMATICS-III	3	1	0	4	30	-	30	70	-	70	100
UFLUIAE302	FLUID MECHANICS & OPEN CHANNEL HYDRAULICS	3	0	0	3	30	-	30	70	-	70	100
USOILAE303	SOIL MECHANICS	3	0	0	3	30	-	30	70	-	70	100
UBASIAE304	BASIC ELECTRONICS	3	0	0	3	30	-	30	70	-	70	100
USTREAE305	STRENGTH OF MATERIALS & THEORY OF STRUCTURE	3	1	0	4	30	-	30	70	-	70	100
UENVIAE306	ENVIRONMENT & ECOLOGY	3	0	0	3	30	-	30	70	-	70	100
UFLUIAE307	FLUID MECHANICS & OPEN CHANNEL HYDRAULICS LAB	0	0	2	1	-	25	25	-	25	25	50
USOILAE308	SOIL MECHANICS LAB	0	0	2	1	-	25	25	-	25	25	50
UBASIAE309	BASIC ELECTRONICS LAB	0	0	2	1	-	25	25	-	25	25	50
USTREAE310	STRENGTH OF MATERIALS & THEORY OF STRUCTURE LAB	0	0	2	1	-	25	25	-	25	25	50
	Total	18	2	8	24	180	100	280	420	100	520	800

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L	T	P
3	1	0

UENGIAE301:ENGINEERING MATHS–III

UNIT I

Numerical Techniques – I: Zeroes of transcendental and polynomial equations, Bisection method, Regula-falsi method, Newton-Raphson method, Rate of convergence of above methods.
Interpolation: Finite differences, Newton's forward and backward interpolation. Lagrange's and Newton's divided difference formula for unequal intervals**.**

UNIT II

Numerical Techniques –II: Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss- Seidal method.
Numerical differentiation & Integration: Trapezoidal rule, Simpson's one third and three- eight rules, Solution of ordinary differential equations (first order, second order and simultaneous) by Euler's, Picard's and fourth-order Runge- Kutta methods.

UNIT III

Statistical Techniques: Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non – linear and multiple regression analysis, Binomial, Poisson and Normal distributions. Tests of significations: Chi-square test, t-test.

UNIT IV

Function of Complex variable: Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem.

UNIT V

Integral Transforms: Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- Transform and its application to solve difference equation.

Text Books:
 1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
 2. Jain, Iyenger Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi
 3. J.N. Kapur, Mathematical Statistics, S. Chand & company Ltd.
 4. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers

Reference Books:
 1.R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House.
 2.Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.
 3.S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, New Delhi.
 4.E. Balagurusamy, Numerical Methods, Tata McGraw-Hill Publishing Company Limited, New Delhi
 5.T. Veerajan & T. Ramchandrandran, Theory & Problems in Numerical Methods, TMH, New Delhi

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L	T	P
3	0	0

UFLUIAE302: FLUID MECHANICS & OPEN CHANNEL HYDRAULICS

UNIT I
Properties of fluids: Ideal and real fluid. Newtonian and non Newtonian fluid, Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, Meta centre and Meta centric height, condition of floatation and stability of submerged and floating bodies.

UNIT II
Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon.

UNIT III
Laminar flow: Stress strain relationships, flow between infinite parallel plates both plates fixed, average velocity; Laminar and turbulent flow in pipes, general equation for head loss Darcy, Equation, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient; Chezy's formula for loss of head in pipes, Flow through simple and compound pipes, Dupit equation.

UNIT IV
Dimensional analysis and similitude: Rayleigh's method and Buckingham's `Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid machinery, Centrifugal pump – construction work done, heads and its efficiencies, NPSH, priming. Reciprocating pump and its working, slip and classification. Turbine- introduction, classification, pelton wheel, Francis, Kaplan turbine and its practical application.

Suggested Reading:
1. Khurmi, RS 1970. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines S. Chand & Company Limited, New Delhi.
2. Modi, PM and Seth, SM 1973. Hydraulics and Fluid Mechanics. Standard Book House, Delhi.
3. Chow, VT, 1983. Open Channel Hydraulics. McGraw Hill Book Co., New Delhi.
4. Lal Jagadish, 1985. Fluid Mechanics and Hydraulics. Metropolitan Book Co. Pvt. Ltd., New Delhi.

L	T	P
3	0	0

USOILAE303: SOIL MECHANICS

UNIT I
Nature and origin of soil; Soil forming rocks and minerals their classification and composition, important physical properties of soil.

UNIT II
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 Wester guards analysis, new mark influence chart.

UNIT III
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. Numerical exercise based on various types of tests. Compaction, composition of soils standard and modified protector test, 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.

UNIT IV
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 exercises. Stability of slopes: introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number.

Suggested Reading
1. Soil Mechanics, BC Punmia; Laxmi Publication (P) Ltd. New Delhi.
2. Punmia BC, Jain AK and Jain AK, 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi.
3. Ranjan Gopal and Rao ASR, 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.
4. Singh Alam, 1994. Soil Engineering Vol. I. CBS Publishers and Distributions, Delhi.
5. Sundarajan, V, 2002. Engineering Mechanics and Dynamics. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Timoshenko, S and Young, DH, 2003. Engineering Mechanics. McGraw Hill Book Co., New Delhi.
7. Prasad, IB, 2004. Applied Mechanics. Khanna Publishers, New Delhi.
8. Prasad, IB, 2004. Applied Mechanics and Strength of Materials. Khanna Publishers, New Delhi.
9. Indian Society of Soil Science.1998. Fundamental of Soil Science, IARI, New Delhi.
10. Brady, Nyle C and Ray, R well, 2002. Nature and properties of soils. Pearson Education Inc; New Delhi.

L	T	P
3	0	0

UBASIAE304: BASIC ELECTRONICS

UNIT I
Semiconductors, p-n junction, V-I characteristics of p-n junction, junction breakdown, diode application-rectifier, clipper, clamper, filter.

UNIT II
Bipolar junction transistor: introduction, various configuration of BJT, statics characteristics, operating point, load line analysis ,classification (A, B & C) of amplifier, various Biasing methods (fixed, self, potential divider), FET, MOSFET.

UNIT III
OP- AMP, ideal OP-AMP characteristics, linear and non-linear applications of OP-AMP (adder, subtractor, integrator, comparator, differentiator), inverting and non inverting amplifier, OP-AMP voltage regulator.

UNIT IV
Special diodes – Zener diode, varactor diode. LED, laser physics, semiconductor laser, PIN photodiode, avalanche photodiode, solar cell, photoconductor. Boolen algebra ,logic gate,k-map,combinational logic circuit ,half adder, full adder, Half subtractor ,full subtractor ,basic sequential circuits.

Suggested Reading:
1. Mehta V K. Principles of Electronics. S. Chand and Co., New Delhi.
2. Shaney A K. Measurement of Electronics and Electronic Instrumentation. Khanna Publications.
3. Roy Chowdary. Integrated Electronics. John Wiley International.
4. Kumar Anand. Digital Electronics. A. PHI.
5. Gupta Sanjeev, Sonthosh Gupta. Electronic Devices and Circuits. Danapath Rai Publications.

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II Year III Semester

L	T	P
3	1	0

USTREAE305: STRENGTH OF MATERIALS & THEORY OF STRUCTURE

UNIT I
Simple stresses and strain Shear force and bending moment diagrams. Review of pure bending, Direct and shear stresses in beams due to transverse and axial loads. Analysis of statically intermediate beams. Propped beams, Fixed and continuous beams.

UNIT II
Slope and deflection of beams using Mcauley techniques, moment area theorems and conjugate beam method. Compound stress and strains: Principal stress and strain. Mohr's stress circle, three dimensional states of stress and strain, Torsion of circular shaft and non- circular shaft.

UNIT III
Columns and struts, derivation of buckling load equation for both end hinged, one end fixed and other end free, both end fixed & one end fixed and other end hinged, Empirical formula for columns.

UNIT IV
Loads and use of BIS Codes. Design of connections. Design of structural steel members in tension, compression and bending. Design of steel roof truss.

UNIT V
Design of Flanged Beams, Slabs, Columns, Foundations, Retaining walls and Silos. Analysis and design of singly and doubly reinforced sections, Shear, Bond and Torsion.

Suggested Reading:
1. Ramamrutham, S, 2003. Strengths of Materials. Dhanpat Rai and Sons, Nai Sarak, NewDelhi.
2. Khurmi, RS, 2001. Strength of Materials S. Chand & Co., Ltd., New Delhi.
3. Sundarajan, V, 2002. Engineering Mechanics and Dynamics. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Junarkar, SB, 2001. Mechanics of Structures, Vol. I, Charotar Publishing Home, Anand.
5. Khurmi, RS, 2001. Strength of materials. S. Chand & Company Ltd., 7361, Ram Nagar, New Delhi – 110055.
6. Kumar, Shushil, 2003. Prrasure of R.C.C Design. R.K. Jain. 1705 Nai Sarsde, Delhi- 110006.

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L	T	P
3	0	0

UENVIAE306: ENVIRONMENT & ECOLOGY

UNIT-I: Definition, Scope& Importance, Need For Public Awarene**ss• Environmentdefinition,** Eco system - Balanced ecosystem, Human activities - Food,Shelter, Economic and social Security. Effects or human activities on environment·Agriculture, Housing,Industry, Mining and Transportation activities, Bask$ of Environmental Impact Assessment. Sustainable Development.

UNIT-II : Natural Resources Water Resources· Availability and Quality aspects.Water borne diseases, Water Induced diseases, Fluoride problem indrinking water. Mineral Resources, Forest Wealth, Material Carbon ,Nitrogen and Sulphur Cycles. Energy - Different types of energy, Electromagnetic radiation.Conventional and Non-Conventional sources - Hydro Electric, Fossil Fuel based Nuclear, Solar, Biomass and Bio.gas. Hydrogen gas and alternativefuture source of Energy.

UNIT-Ill: Environmental Pollution and their effects. Water pollution, Land pollution. Noise pollution, Public Health aspects, Air Pollution, Solid waste management, e-waste management Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution. Acid Rain Ozone Layer depletion, Animal Husbandry,

UNIT-IV : Environment-ill Protection- Role of Government, Legal aspects, initiatives by Non-, governmental organizations (NGO), Environmental Education,

Text books:

l.Environmental Studies -Benny Joseph-Tata McgrawHiU-200S
2. Environmental Studies- Dr. D.l. Manjunath, Pearson Education-2006.
3.Environmental Science & Technology- M. Anaji Reddy- BS Publication .

L	T	P
0	0	2

UFLUIAE307: FLUID MECHANICS & OPEN CHANNEL HYDRAULICS LAB

1. Study of manometers and pressure gauges

2. Verification of Bernoulli's theorem

3. Determination of coefficient of discharge of venture-meter and orifice meter

4. Determination of coefficient in pipeline

5. Determination of coefficient of discharge for rectangular and triangular notch

6. Determination of coefficient of discharge for mouth piece

7. Measurement of force exerted by water jets on flat and hemispherical vanes

8. Determination of meta-centric height

9. Determination of efficiency of hydraulic ram

10. Performance evaluation of Pelton and Francis turbine

11. Study of current meter

12. Velocity distribution in open channels and determination of Manning's coefficient of rugosity.

L	T	P
0	0	2

<u>USOILAE308: SOIL MECHANICS LAB</u>

1. Determination of water content of soil.

2. Determination of specific gravity of soil.

3. Determination of field density of soil by core cutter method.

4. Determination of field density by sand replacement method.

5. Grain size analysis by sieving (Dry sieve analysis).

6. Grain size analysis by hydrometer method.

7. Determination of shrinkage limit.

8. Determination of permeability by constant head method.

9. Determination of permeability by variable head method.

10. Problems on composition and resolution of forces,

11. Moments of a force, couples, transmission of a couple,

12. Resolution of a force into a force & a couple; Problems relating to resultant of;

13. Co-planer force system, collinear force system, concurrent force system,

14. Co-planer concurrent force system,

15. Co-planer non-concurrent force system,

16. Non-coplaner concurrent force system,

17. Non-coplaner non-concurrent force system,

18. System of couples in space;

19. Problems relating to centroids of composite areas.

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L	T	P
0	0	2

UBASIAE309: BASIC ELECTRONICS LAB

1. To study V-I characteristics of p-n junction diode;

2. To study half wave, full wave and bridge rectifier;

3. To study transistor characteristics in CE configurations;

4. To design and study fixed and self bias transistor;

5. To design and study potential divider bias transistor;

6. To study a diode as clipper and clamper;

7. To study a OP-AMP IC 741 as inverting and no inverting amplifier;

8. To study a OP-AMP IC 741 as differentiator amplifier;

9. To study a differential amplifier using two transistors;

10. To study a OP-AMP IC 741 as differential amplifier.

L	T	P
0	0	2

USTREAE310: STRENGTH OF MATERIALS & THEORY OF STRUCTURE LAB

1. To perform the tension test on metal specimen (M.S., C.I.), to observe the behaviour of materials under load, to calculate the value of E, ultimate stress, permissible stress, percentage elongation etc. and to study its fracture.
2. To perform the compression test on; Concrete cylinders &cubes, C.I., M.S. & Wood specimens and to determine various physical and mechanical properties.
3. To perform the bending tests on the specimens; M.S. Girder, Wooden beam, Plain concrete beams & R.C.C. beam, and to determine the various physical and mechanical properties.
4. To determine Young's modulus of elasticity of beam with the help of deflection produced at centre due to loads placed at centre & quarter points.
5. To study the behaviour of materials (G.I. pipes, M.S., C.I.) under torsion and to evaluate various elastic constants;
6. To study load deflection and other physical properties of closely coiled helical spring in tension and compression.
7. To perform the Rockwell, Vicker's and Brinell's Hardness tests on the given specimens.
8. To perform the Drop Hammer Test, Izod Test and Charpay's impact tests on the given specimens.
9. To determine compressive & tensile strength of cement after making cubes and briquettes.
10. Design and drawing of single reinforced beam, double reinforced beam,
11. Design and drawing of steel roof truss.
12. Design and drawing of one way, two way slabs,
13. Design and drawing of RCC building.
14. Design and drawing of Retaining wall.
15. To measure workability of cement by slump test.

EVALUATION SCHEME
B.TECH - AGRICULTURE ENGINEERING(4th Sem)

STUDY AND EVALUATION SCHEME
B.TECH. AGRICULTURE ENGG. - 4th Semester

SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	Marks In Evaluation Scheme						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
UNANOAE401	Nano Science	3	0	0	3	30	-	30	70	-	70	100
UPOSTAE402	Post Harvest Engg. of Cereals, Pulses & Oil Seeds	3	1	0	4	30	-	30	70	-	70	100
UWATEAE403	Watershed Hydrology, Soil & Water Conservation Engineering	3	1	0	4	30	-	30	70	-	70	100
UTHEOAE404	Theory of Machines & Machine Design	3	1	0	4	30	-	30	70	-	70	100
UFARMAE405	Farm Machinery and Equipment-I	3	1	0	4	30	-	30	70	-	70	100
UUNIVAE406	Universal Human Values & Professional Ethics	3	0	0	1	--	25	25	-	25	25	50
UPOSTAE407	Post Harvest Engg. of Cereals, Pulses & Oil Seeds Lab	0	0	2	1	-	25	25	-	25	25	50
UWATEAE408	Watershed Hydrology, Soil & Water Conservation Engineering Lab	0	0	2	1	-	25	25	-	25	25	50
UFARMAE409	Farm Machinery and Equipment-I Lab	0	0	2	1	-	25	25	-	25	25	50
USOILAE410	Soil & Water Conservation Lab	0	0	2	1	-	25	25	-	25	25	50
Total		18	4	8	24	150	125	275	350	125	475	750

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L	T	P
3	0	0

UNANOAE401: NANO SCIENCE

UNIT I : Introduction: Definition of Nano-Science and Nano Technology, Applications of Nano-Technology.Quantum Theory for Nano Science: Particle in a box, Potential step: Reflection and tunneling (Quantumleak). Penetration of Barrier, Potential box (Traped particle in 3D: Nanodot).Physics of Solid State Structures: Size dependence of properties, crystal structures, face centered cubicnanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations.Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps ofsemiconductors; effective masses; Fermi Surfaces. Localized Particles: Acceptors and deep taps; mobility; Excitons.

UNIT II: Quantum Nanostructure: Preparation of quantum wells, Wires and Dots, Size and Dimensionality effect,Fermi gas; Potential wells; Partial confinement; Single electron Tunneling, Infrared detectors; Quantumdot laser superconductivity.Properties of Individual Nano Particles: Metal nano clusters; Magic numbers; Theoretical modeling ofnanoparticles; geometric structure; electronic structure; Reactivity, Fluctuations, Magnetic clusters; Bulkto nanostructure, semiconducting nanoparticles, Optical Properties, Photofragmentation, ColumbicExplosion. Rare Gas & Molecular clusters; Inert gas clusters; Superfluid clusters; Molecular clusters.

UNIT III: Growth Techniques of Nano materials: Litho and Nonlitho grapahic techniques, RF Plasma, Chemicalmethods, Thermolysis, Pulsed laser method, Self-assembly, E-beam evaporation, Chemical VapourDeposition, Pulsed Laser Deposition.

UNIT IV: Methods of Measuring Properties: Structure: X-ray Diffraction Technique, Particle size determination,surface structure. Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM),Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy(TEM).Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical andVibrational Spectroscopy, Luminescence.

UNIT V: Carbon Nano Materials: Bucky Ball and Carbon Nano- Tubes: Nano structures of carbon (fullerene),Fabrication, Structure. Electrical, Mechanical and Vibrational properties and applications. NanoDiamond, Boron Nitride Nano-tubes, Single Electron Transistors, Molecular Machine, Nano-Biometrics, Nano Robots.

Text/Reference Books:
1. **CP Poole Jr, FJ Owens, "Introduction to Nanotechnology".**

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L	T	P
3	1	0

UPOSTAE402: POST HARVEST ENGG. OF CEREALS, PULSES & OIL SEEDS

UNIT I
Applications of unit operations and principles in cleaning and grading, aspiration, scalping; size separators, screens, sieve analysis, capacity and effectiveness of screens. Various types of separators: specific gravity, magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, colour sorters, cyclone, shape graders. Size reduction: principle, Bond's law, Kick's law, Rittinger's law, procedure (crushing, impact, cutting and shearing), And Size reduction machinery: Jaw crusher, Hammer mill, Plate mill, Ball mill. Material handling equipment. Types of conveyors: Belt, roller, chain and screw.

UNIT II
Elevators: bucket, Cranes & hoists. Trucks (refrigerated/ unrefrigerated), Pneumatic conveying. Drying: moisture content and water activity; Free, bound and equilibrium moisture content, isotherm, hysteresis effect, EMC determination, Psychrometric chart and its use in drying, Drying principles and theory, Thin layer and deep bed drying analysis, Falling rate and constant rate drying periods, maximum and decreasing drying rate period, drying equations, Mass and energy balance, Shedd's equation, Dryer performance, Different methods of drying, batch-continuous; mixing-non-mixing, Sun-mechanical, conduction, convection, radiation, superheated steam, tempering during drying, Different types of grain dryers: bin, flat bed, LSU, columnar, RPEC, fluidized, rotary and tray.

UNIT III
Mixing: Theory of mixing of solids and pastes, Mixing index, types of mixers for solids, liquid foods and pastes. Milling of rice: Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpur methods, Pressure parboiling method, Types of rice mills, Modern rice milling, different unit operations and equipment. Milling of wheat, unit operations and equipment.

UNIT IV
Milling of pulses: traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods. Pulse milling machines, Milling of corn and its products. Dry and wet milling. Milling of oilseeds: mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, refining of oil, stabilization of rice bran., Extrusion cooking: principle, factors affecting, single and twin screw extruders. By-products utilization.

Suggested Reading:
1. Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
2. Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations. Kalyani Publishers, New Delhi.
3. Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.
4. Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi
5. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
6. Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London
7. McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.
8. Singh, R. Paul. and Heldman, R.Dennis. 2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.

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L	T	P
3	1	0

UWATEAE403:
WATERSHED HYDROLOGY, SOIL & WATER CONSERVATION ENGINEERING

UNIT I
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. Runoff - Factors affecting, measurement, and stage - discharge rating curve, estimation of peak runoff rate and volume, rational method, Cook's method and SCS curve number method.

UNIT II
Geomorphology of watersheds – Linear, aerial and relief aspects of watersheds- stream order, drainage density and stream frequency. 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 III
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. Gullies - Classification, stages of development. Soil loss estimation – Universal soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation by $KE>25$ and EI_{30} methods. Soil erodibility - topography, crop management and conservation practice factors. Measurement of soil erosion - Runoff plots, soil samplers.

UNIT IV
Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching. 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.

UNIT V
Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains. 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 Reading:
1. Raghunath, HM, 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Limited Publishers, New Delhi.
2. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.
3. Chow, VT, D.R. Maidment and L.W. Mays. 2010. Applied Hydrology, McGraw Hill Publishing Co., New York.
4. Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press, New Delhi.

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L	T	P
3	1	0

UTHEOAE404: THEORY OF MACHINES & MACHINE DESIGN

UNIT I
Introduction to machine and design Principle of design, Phases of design, design considerations. 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. Cam, Types of cam, Terminology used in cam-follower system, Cam profile.

UNIT II
Types of gears. Law of gearing, velocity of sliding between two teeth in mesh. Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear, Design of spur and helical gears.
Gear train, Determination of velocity ratio and train value by using tabular method.

UNIT III
Types of loads and stresses, theories of failure, factor of safety, selection of allowable Stress. Stress concentration. Elementary fatigue and creep aspects. Design of Cotter joints, knuckle joint and Design of welded subjected to static loads, Design of shafts under torsion and combined bending and torsion, sleeve, and rigid flange couplings.

UNIT IV
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. Design of screw motion mechanism like screw jack, lead screw. Bearing-Rolling friction, anti friction bearings. Types of governors. Constructional details and analysis of Watt, Porter, Proell governor.

Suggested Reading:
1. Rattan, SB, 1993. Theory of Machines. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi.
2. Khurmi R S and Gupta J K. 1994. Theory of Machines. Eurasia Publishing House Pvt. Ltd., Ram Nagar, New Delhi.
3. Bhandari V B. Machine Design Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi.

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UFARMAE405: FARM MACHINERY AND EQUIPMENT-I

UNIT I

Introduction to farm mechanization. Classification of farm machines. Unit operation in crop production. Hitching systems and controls of farm machinery. Calculation of field capacity and field efficiency.

UNIT II

Introduction to seed-bed preparation . Familiarization with land reclamation and earth moving equipment. Machinery used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage and conservation tillage. Measurement of draft of tillage tools and calculations for power requirement for the tillage machines.Tillage machines like mould- board plough, disc plough, chisel plough, sub-soiler, harrows, cultivators, Identification of major functional components. Attachments with tillage machinery.

UNIT III

Introduction to sowing, planting & transplanting equipment. Working of seed drills, no-till drills, happy seeder and strip-till drills. Brief description and working of 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. 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.

UNIT IV

Selection of farm machinery. Calculation for economics of machinery usage comprasion of owenering with hiring of machinries and analysis of payback period of farm machinery.

Suggested Reading:
1. Kepner RA, Roy Barger & EL Barger. Principles of Farm Machinery.
2. Smith HP and LH Wilkey. Farm Machinery and Equipment.
3. Culpin Claude. Farm Machinery.
4. Srivastava AC. Elements of Farm Machinery.
5. Lal Radhey and AC Datta. Agricultural Engineering. through solved examples, Saroj Publication, Allahabad,

Department of Agriculture Engineering
(Faculty of Engineering &Technology)
P.K.University, Shivpuri(MP)
II Year IV Semester

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UUNIVAE406 : UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS

UNIT 1:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 1. Understanding the need, basic guidelines, content and process for Value Education

2. Self Exploration–what is it? - **its content and process; „Natural Acceptance" and Experiential**

Validation- as the mechanism for self exploration

3. Continuous Happiness and Prosperity- A look at basic Human Aspirations

4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority

5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT 2:

Understanding Harmony in the Human Being - Harmony in Myself!
7. Understanding human being as a co-**existence of the sentient „I" and the material „Body"**

8. Understanding the needs of Self („I") and „Body" - Sukh and Suvidha

9. Understanding the Body as an instrument of **„I" (I being the doer, seer and enjoyer)**

10.Understanding the characteristics and activities of „I" and harmony in „I"

11.Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail

12.Programs to ensure Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 3:

Understanding Harmony in the Family and Society- Harmony in HumanHuman Relationship
13.Understanding Harmony in the family – the basic unit of human interaction

14.Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship

15.Understanding the meaning of Vishwas; Difference between intention and competence

16.Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship

17.Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals

18.Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 4:

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence 19.Understanding the harmony in the Nature

20.Interconnectedness and mutual fulfillment among the four orders of naturerecyclability and self-regulation in nature

21.Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space

22.Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 5:

Implications of the above Holistic Understanding of Harmony on Professional Ethics
23.Natural acceptance of human values
24.Definitiveness of Ethical Human Conduct
25.Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26.Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order

b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems,

c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

27. Case studies of typical holistic technologies, management models and production systems

28.Strategy for transition from the present state to Universal Human Order:

 a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
 b) At the level of society: as mutually enriching institutions and organizations

Books and References:

1.R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

2. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted 2008.

3. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.

4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986,

5.A.N. Tripathy, 2003, Human Values, New Age International Publishers.

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UPOSTAE407 : POST HARVEST ENGG. OF CEREALS, PULSES & OIL SEEDS LAB

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,

7. Study on drying characteristics of grains and determination of drying constant,

8. Determination of EMC (Static and dynamic method),

9. Study of various types of dryers,

10. Study of different equipments in rice mills and their performance evaluation,

11. Study of different equipments in pulse mills and their performance evaluation,

12. Study of different equipments in oil mills and their performance evaluation,

13. Type of process flow charts with examples relating to processing of cereals pulses and oil seeds,

14. Visit to grain processing industries.

Department of Agriculture Engineering
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II Year IV Semester

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UWASTAE408 : WATERSHED HYDROLOGY, SOIL & WATER CONSERVATION ENGINEERING LAB

1. Visit to meteorological observatory and study of different instruments.
2. Design of rain gauge network. Exercise on intensity - frequency - duration curves.
3. Exercise on intensity-frequency-duration curves
4. Exercise on depth - area - duration and double mass curves.
5. Analysis of rainfall data and estimation of mean rainfall by different methods.
6. Exercise on frequency analysis of hydrologic data and estimation of missing data, test for consistency of rainfall records.
7. Exercise on computation of infiltration indices.
8. Computation of peak runoff and runoff volume by Cook's method and rational formula.

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UFARMAE409 : FARM MACHINERY AND EQUIPMENT-I LAB

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 and calculations of power and draft requirements.

4. Study of sowing and planting equipment – construction, types, calculation for calibration and adjustments.

5. Study of transplanters – paddy, vegetable, etc.

6. Identification of materials of construction in agricultural machinery and study of material properties.

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

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USOILAE410 : SOIL & WATER CONSERVATION LAB

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. Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE.

5. Exercises on soil loss estimation/measuring techniques.

6. Study of rainfall simulator for erosion assessment.