



## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | MT248                                                                                                                                    | Title of the Course | Engineering Mathematics-I | L | 3 | T | 0 | P | 0 | C | 3 |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------|---|---|---|---|---|---|---|---|
| Year              | II                                                                                                                                       | Semester            | III                       |   |   |   |   |   |   |   |   |
| Course Objectives | To make the students acquainted with the basic mathematics applied in engineering and their applications in solving engineering problems |                     |                           |   |   |   |   |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                        |
|------------|--------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand differential Equations and solve first-order differential equations using standard methods. |
| <b>CO2</b> | Analyze and solve higher-order differential equations.                                                 |
| <b>CO3</b> | Apply multivariable calculus for partial derivatives and optimization.                                 |
| <b>CO4</b> | Solve partial differential equations and evaluate multiple integrals.                                  |
| <b>CO5</b> | Evaluate matrices using inverse, eigenvalues, and diagonalization methods.                             |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                   | Contact Hrs. | Mapped CO |
|----------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | <b>Unit 1</b>     | Differential Equations: First order differential equations, exact and reducible to exact form by integrating factors, linear differential equation and Bernoulli's equation, equations of first order and higher degree, Clairaut's equation.                                                                     | 10           | CO1       |
| 2        | <b>Unit 2</b>     | Higher order differential equations: Methods of finding complementary functions and particular integrals, methods of variation of parameters, Cauchy's and Legendre's linear equations, simultaneous linear differential equations with constant coefficients.                                                    | 12           | CO2       |
| 3        | <b>Unit 3</b>     | Differential calculus: Functions of two or more variables, Taylor's and Maclaurin's expansions, Maxima and minima. Partial differential equations: Partial derivative and total derivative, homogeneous functions and Euler's theorem.                                                                            | 10           | CO3       |
| 4        | <b>Unit 4</b>     | Formation of PDE, higher order linear PDE with constant coefficients, solution of non-linear PDE, Charpit's method. Integral calculus: Double integrals, change of order of integration, triple integrals, application of double and triple integrals to find area and volume.                                    | 10           | CO4       |
| 5        | <b>Unit 5</b>     | Matrices: Elementary transformations, Gauss elimination, Gauss-Jordan method to find the inverse of a matrix. rank of a matrix, solution of linear equations, Eigen values and Eigen vectors, Cayley-Hamilton Theorem- its use to find inverse of the matrix, linear transformation, diagonalization of matrices. | 10           | CO5       |

### Suggested Readings:

1. Grewal, B. S. 2004. *Higher Engineering Mathematics*. Khanna Publishers Delhi.
2. Narayan, S. 2004. *A Text Book of Vector*. S. Chand and Co. Ltd. New Delhi.
3. Narayan, S. 2004. *Differential Calculus*. S. Chand and Co. Ltd. New Delhi.
4. Narayan, S. 2004. *Integral Calculus*. S. Chand and Co. Ltd. New Delhi.

### e-Learning Source:

<https://agrimoon.com/agricultural-engineering-icar-ecourse-pdf-books-free-download/>

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-PSO CO                                                      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 3   | 2   | 2   | 2   | 2   | 2   | 2   | 1   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 2    |
| CO2                                                            | 3   | 2   | 1   | 2   | 1   | 2   | 1   | 1   | 1   | 2    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 2    |
| CO3                                                            | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 2    |
| CO4                                                            | 3   | 2   | 1   | 2   | 1   | 2   | 1   | 2   | 1   | 2    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 2    |
| CO5                                                            | 3   | 2   | 3   | 2   | 1   | 2   | 1   | 2   | 1   | 2    | 1    | 2    | 1    |      | 1    | 2    | 1    | 3    | 2    | 1    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



## Integral University, Lucknow

|                                               |                               |
|-----------------------------------------------|-------------------------------|
| <b>Name &amp; Sign of Program Coordinator</b> | <b>Sign &amp; Seal of HoD</b> |
|-----------------------------------------------|-------------------------------|



## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | PY216                                                                                                                                    | Title of the Course | Engineering Physics | L | T | P | C |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---|---|---|---|
| Year              | II                                                                                                                                       | Semester            | III                 | 2 | 0 | 1 | 3 |
| Course Objectives | To make the students acquainted with applications of physics in engineering and different physical processes in agricultural engineering |                     |                     |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                                                                                    |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the concepts of magnetism and basic quantum mechanics.                                                                                                                  |
| <b>CO2</b> | Analyze spectral effects and band theory of solids.                                                                                                                                |
| <b>CO3</b> | Apply principles of semiconductors and superconductivity.                                                                                                                          |
| <b>CO4</b> | Explain concepts of lasers, optical fibre, and illumination.                                                                                                                       |
| <b>CO5</b> | Understand and apply experimental methods to determine physical parameters such as e/m ratio, dielectric constant, band gap, and resistance using standard laboratory instruments. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                | Contact Hrs. | Mapped CO |
|----------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Magnetism: Dia, para and ferro-magnetism- classification; Langrevin theory of dia, and para magnetism, adiabatic demagnetization, Weiss molecular field theory; Introduction to quantum mechanics: wave particles duality, deBroglie concept uncertainty principle, time dependent and time independent Schrodinger equation.                                                                                  | 8            | CO1       |
| 2        | Unit 2            | Spectroscopy: Qualitative explanation of Zeeman effect, Stark effect and Paschen back effect, Raman spectroscopy; Solid state physics: statement of Bloch function, bands in solids, effective mass, distinction between metals, insulators and semi-conductors.                                                                                                                                               | 8            | CO2       |
| 3        | Unit 3            | Semiconductors: Intrinsic and extrinsic semi-conductors, law of mass action, determination of energy gap in semi-conductors, donors and acceptor levels; Superconductivity: super conductivity, critical magnetic field, Meissner effect, isotope effect, Type I and II superconductors, Josephson effect, DC and AC squids, introduction to high $T_c$ superconductors.                                       | 8            | CO3       |
| 4        | Unit 4            | LASERS and MASERS: Spontaneous and stimulated emission, Einstein A and B coefficients, population inversion, He, Ne and Ruby lasers, Ammonia and Ruby masers; Holography and optical fibre: optical fibre- physical structure, basic theory, type of modes, characteristics of optical fibre and applications; Illumination: laws of illumination, luminous flux, luminous intensity, candle power, brightness | 10           | CO4       |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|
| To verify law of transverse vibrations along a string using electrical tuning fork; To determine e/m of electron using magnetron valve method; Determine dielectric constant of material using De Sautys bridge; Study the variation of magnetic field with distance along the axis of a current carrying circular coil and to determine the radius of the coil; Determine the energy band gap in a semiconductor using a p-n junction diode; Study the LCR circuit; Find the wave length of light by using prism and spectrometer; Determine the low resistance using Carey Foster bridge without calibrating the bridge wire. | 30 | CO5 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|

### Suggested Readings:

1. Avadhanulu, M. N. 2013. *An Introduction to Lasers theory and applications*. S. Chand Publication.
2. Chattopadhyay, D. and Rakshit, P. C. 2011. *Electricity and Magnetism*. S. Chand Publication.
3. Ghatak, A. K. and Lokanathan, S. 2022. *Quantum Mechanics, Theory and Application*. Trinity Press.
4. Griffiths, D. J. and Schroeter. 2018. *Introduction to Quantum Mechanics*. Cambridge University Press

### e-Learning Source:

<https://agrimoon.com/engineering-physics-pdf-book/>



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| <b>Name &amp; Sign of Program Coordinator</b> | <b>Sign &amp; Seal of HoD</b> |
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## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | CH201                                                                                                                                               | Title of the Course | Engineering Chemistry | L | T | P | C |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------|---|---|---|---|
| Year              | II                                                                                                                                                  | Semester            | III                   | 2 | 0 | 1 | 3 |
| Course Objectives | To make the students acquainted with applications of chemistry in engineering and different chemical processes in agricultural and food engineering |                     |                       |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                |
|------------|----------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand phase rule, corrosion control, and colloidal properties in practical systems.                       |
| <b>CO2</b> | Explain water treatment, fuel properties, and basic analytical techniques.                                     |
| <b>CO3</b> | Apply principles of food chemistry and lubrication in industrial processes.                                    |
| <b>CO4</b> | Understand polymer properties and interpret IR spectroscopy data.                                              |
| <b>CO5</b> | Apply and evaluate standard analytical methods to determine water quality parameters and verify chemical laws. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Contact Hrs. | Mapped CO |
|----------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Phase rule: Phase, component, degree of freedom, application to one component system, viz. water system, sulphur system, two component system, viz. pb-Ag system, desilverisation of Pb. Colloids: Classification, properties like optical activity-Tyndall effect, Brownian movement, electrical properties – electrophoresis, causes, types and methods of prevention- proper designing. Corrosion: Cathodic protection using pure metal and metal alloys, use of inhibitors.                                                                                                                                                     | 8            | CO1       |
| 2        | Unit 2            | Water: Temporary and permanent hardness, disadvantages of hard water, scale and sludge formation of boilers, boiler corrosion, basic idea on thermo-gravimetric analysis, polarographic analysis, nuclear radiation, detectors and analytical applications of radio-active materials, discovery of isotopes and new elements, release of atomic energy, radio-active tracer and carbon dating. Fuels: Classifications, calorific value and its determination by bomb calorimeter.                                                                                                                                                   | 8            | CO2       |
| 3        | Unit 3            | Principles of food chemistry: Lipids, proteins, carbohydrates and their classifications, vitamins and their importance. Enzymes and co-enzymes important in food processing and storage, their use in manufacturing of ethanol and acetic acid by fermentation method. Introduction to food preservatives, definition, types natural and artificial preservative and its use, colouring and flavoring reagents of foods. Lubricants: Classifications, properties-viscosity, flash point and fire point mechanism, thick film, thin film and extreme pressure, neutralization point, saponification number and mechanical stability. | 8            | CO3       |
| 4        | Unit 4            | Type of polymerization with examples (addition, free radical); Different properties of polymerschemical resistance, crystallinity. Polymers: Effect of heat on polymers, general use, basic principles of determination of molecular weight by viscosity methods, basic principles of determination of molecular weight by light scattering methods. Introduction to IR spectroscopy: Basic principles of spectroscopy, Beer-Lamberts law, types of vibration, symmetric, asymmetric vibration and it type, absorbances of different functional group in IR.                                                                        | 8            | CO4       |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|
| To determine of temporary and permanent hardness of water by EDTA method; To study the different types of fuels and compare their characteristics; To study different types of foods and their ingredients; To study the different types of food preservatives and their active principles; To estimate chloride in water sample; To estimate dissolved oxygen in water sample; To estimate chloride in water samples; To study the different properties of lubricants; To determine $\lambda_{\max}$ and verification of Beer-Lambert law. | 30 | CO5 |
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## Integral University, Lucknow

### Suggested Readings:

1. Bahl, B. S., Bahl, A. and Tuli, B. D. 2007. *Essentials of Physical Chemistry*. S. Chand and Co. Ltd, Delhi.
2. Finar, I. L. 2002. *Organic Chemistry*. Vol I and II. Pearson.
3. Glasstone, S. *Elements of Physical Chemistry*. The Macmillan Company of India Limited.
4. Jain and Jain. 2016. *Engineering Chemistry*. Dhanpat Rai Publication.

### e-Learning Source:

<https://agrimoon.com/engineering-chemistry-pdf-book/>  
<https://www.nrtec.in/wp-content/uploads/2022/07/ENGINEERING-CHEMISTRY.pdf>

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                               | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 1   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 3    | 2    | 2    | 1    | 3    |
| CO2                                                            | 3   | 2   | 1   | 2   | 1   | 2   | 1   | 1   | 1   | 2    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 2    |
| CO3                                                            | 3   | 1   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 1    | 1    | 2    | 2    | 2    |
| CO4                                                            | 3   | 2   | 1   | 2   | 1   | 2   | 1   | 2   | 1   | 2    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 1    |
| CO5                                                            | 3   | 2   | 1   | 2   | 1   | 2   | 1   | 2   | 1   | 2    | 1    | 2    | 1    |      | 1    | 2    | 1    | 3    | 2    | 1    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

|                                    |                    |
|------------------------------------|--------------------|
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## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE264                                                                                                                                                                     | Title of the Course | Engineering Mechanics | L | T | P | C |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------|---|---|---|---|
| Year              | II                                                                                                                                                                        | Semester            | III                   | 2 | 0 | 1 | 3 |
| Course Objectives | To make the students acquainted with the principles of engineering mechanics and the calculation of different stresses to be helpful for design of engineering structures |                     |                       |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                               |
|------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Recall basic concepts of forces, moments, and equilibrium.                                                                    |
| <b>CO2</b> | Understand and apply concepts of CG, moment of inertia, and friction in problem solving.                                      |
| <b>CO3</b> | Analyze structures, stresses, and shear force and bending moment diagrams.                                                    |
| <b>CO4</b> | Explain and analyze torsion and principal stresses using stress analysis methods.                                             |
| <b>CO5</b> | Understand and explain fundamental concepts of forces, moments, trusses, stress-strain, and torsion in engineering mechanics. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Contact Hrs. | Mapped CO |
|----------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | <b>Unit 1</b>     | Basic concepts of engineering mechanics, statics, dynamics, kinetics, scalar quantities, vector quantities, systems of units. Composition and resolution of forces, analytical method, graphical method. Laws of forces, moments and their application, levers, parallel forces and couples. Equilibrium of forces, free body diagrams.                                                                                                                                                                                                                                                                                                                                     | 8            | CO1       |
| 2        | <b>Unit 2</b>     | Centre of gravity (CG) of simple geometrical figures, CG by moments, plane figures, axis of references, CG of symmetric sections, unsymmetrical sections, solid bodies and cut sections. Moment of inertia: Methods of finding out M.I., methods of integration, M.I. of different sections, Theorem of perpendicular axes, parallel axes, M.I. of composite sections and cut sections. Frictional forces, static friction, dynamic friction, limiting friction, normal reaction, angle of friction, coefficient of friction, laws of friction, equilibrium of a body lying in horizontal and inclined planes, ladder friction; wedge friction, screw friction, screw jack. | 10           | CO2       |
| 3        | <b>Unit 3</b>     | Analysis of simple framed structures, methods of sections, force table, methods of joints, hinged joints, roller support, vertical and inclined loads. Simple stresses and strain, Hooke's law, Poisson's ratio, modulus of elasticity, Strain related problems. Shear force and bending moment, fundamentals of shear force and bending moment, SFD and BMD of cantilever and simply supported and overhanging beams, point of contra-flexure.                                                                                                                                                                                                                             | 8            | CO3       |
| 4        | <b>Unit 4</b>     | Torsion of circular shaft, torsional effect, hoop stress, power transmitted by a shaft. Principal stresses and strain, analysis of plane and complex stress, principal planes and principal stresses, Mohr's circle, finding out principal stresses, different analysis.                                                                                                                                                                                                                                                                                                                                                                                                    | 6            | CO4       |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|
| Problems on composition and resolution of forces; Study the moments of a force; Problems related to resultant of a concurrent-coplanar force system; Problems related to non-concurrent coplanar force system; Systems of couples in space; Problems related to centroids of composite areas; Problems on Moment of Inertia, radius of gyration of composite areas; Analysis of equilibrium of concurrent coplanar and non-concurrent coplanar force system; Problems involved with frictions; Analysis of simple trusses by methods of joints and methods of sections; Analysis of simple trusses by graphical method; Problems on simple stress and strains; Problems on shear and bending moment diagrams. Problems on stresses on beams. Problems on torsion of the shafts; Analysis of plane and complex stresses. | 30 | CO5 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|



## Integral University, Lucknow

### Suggested Readings:

1. Bansal, R. K. 2005. *A Text Book of Engineering Mechanics*. Laxmi Publishers, New Delhi.
2. Khurmi, R. S. 2006. *Strength of Materials*. S. Chand Publishing.
3. Khurmi, R. S. 2018. *A Text Book of Engineering Mechanics*. S. Chand Publishing.
4. Prasad, I. B. 2004. *Applied Mechanics and Strength of Materials*. Khanna Publishers, New Delhi.
5. Prasad, I. B. 2004. *Applied Mechanics*. Khanna Publishers, New Delhi

### e-Learning Source:

<https://ucpesbam.in/public/uploads/dept-study-material/67986e2492fcc.pdf>  
<https://agrimoon.com/agricultural-engineering-icar-ecourse-pdf-books-free-download/>

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                               | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 2   | 3   | 3   | 2   | 2   | 2   | 2   | 1   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 3    | 2    | 1    | 1    | 3    |
| CO2                                                            | 2   | 2   | 3   | 2   | 1   | 2   | 1   | 1   | 1   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 1    | 1    | 2    |
| CO3                                                            | 2   | 3   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 1    | 1    | 2    | 2    | 2    |
| CO4                                                            | 2   | 3   | 1   | 2   | 1   | 2   | 1   | 2   | 1   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 1    |
| CO5                                                            | 2   | 2   | 3   | 2   | 1   | 2   | 1   | 2   | 1   | 2    | 1    | 2    | 1    |      | 1    | 2    | 1    | 3    | 2    | 1    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

|                                    |                    |
|------------------------------------|--------------------|
| Name & Sign of Program Coordinator | Sign & Seal of HoD |
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## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE265                                                                                                                                                                                                            | Title of the Course | Soil Mechanics | L | T | P | C |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------|---|---|---|---|
| Year              | II                                                                                                                                                                                                               | Semester            | III            | 1 | 0 | 1 | 2 |
| Course Objectives | To make the students acquainted with the principles of soil mechanics and the calculation of different stresses in soil, which will be helpful in designing the retaining walls and other engineering structures |                     |                |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                                                                        |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Recall basic concepts of soil properties, classification, and stress distribution.                                                                                     |
| <b>CO2</b> | Explain shear strength concepts and soil testing methods.                                                                                                              |
| <b>CO3</b> | Apply compaction and consolidation principles in soil analysis.                                                                                                        |
| <b>CO4</b> | Analyze earth pressure and slope stability problems.                                                                                                                   |
| <b>CO5</b> | Explain standard laboratory methods for determining soil properties such as moisture content, density, grain size, consistency limits, compaction, and shear strength. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                             | Contact Hrs. | Mapped CO |
|----------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | <b>Unit 1</b>     | Introduction to soil mechanics, field and scope of soil mechanics; Phase diagram, physical and index properties of soil, particle size distribution, grain size distribution curve, soil indices; plastic limit, liquid limit, shrinkage limit; Classification of soils, effective and neutral stress, Boussinesq and Westergaard's analysis, New-mark's influence chart, stress distribution and diagrams. | 5            | CO1       |
| 2        | <b>Unit 2</b>     | Shear stress, Mohr's circle, direct shear stress, triaxial test and vane shear test; Mohr coulomb failure theory, effective stress principle, determination of shear parameters by direct shear test, triangle test and vane shear test. Numerical exercise based on various types of tests.                                                                                                                | 5            | CO2       |
| 3        | <b>Unit 3</b>     | Compaction of soils, standard and modified protector test, Abbot's compaction and Jodhpur mini compaction test, field compaction method and control; Consolidation of soils, Terzaghi's theory of one-dimensional consolidation, spring analogy, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method.                               | 5            | CO3       |
| 4        | <b>Unit 4</b>     | 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, friction circle method.                                             | 3            | CO4       |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|
| Determination of moisture content of soil sample; Determination of specific gravity of soil sample; Study of field density by core cutter; Study of bulk density, dry density by sand replacement method; Determination of grain size distribution of coarse grained soil by sieving; Determination of grain size by hydrometer method; Determination of liquid limit by Casagrande apparatus; Determination of liquid limit by cone penetrometer; Determination of plastic limit of soil specimen; Determination of shrinkage limit of soil; Determination of optimum moisture content of saturated soil by Abbot's compaction test; Determination of optimum moisture content of saturated soil by Proctor's mould; Consolidation characteristics of soil; Shear strength of soil by direct shear test; Shear strength of soil by tri-axial shear test. | 30 | CO5 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|

### Suggested Readings:

1. Punmia, B. C., Jain, A. K. and Jain, A. K. 2005. *Soil Mechanics and Foundations*. Laxmi Publications (P) Ltd. New Delhi.
2. Ranjan, G. and Rao, A. S. R. 1993. *Basic and Applied Soil Mechanics*. Welley Easters Ltd., New Delhi.
3. Singh, A. 1994. *Soil Engineering*. Vol. I. CBS Publishers and Distributions, Delhi.



<https://www.slideshare.net/slideshow/soil-mechanics-note/37714211>  
<https://agrimoon.com/soil-mechanics-pdf-book-free-download/>

|        | Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|--------|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-PSO | PO1                                                            | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO     |                                                                |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
| CO1    | 2                                                              | 3   | 3   | 3   | 2   | 2   | 2   | 1   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 3    | 2    | 1    | 1    | 3    |
| CO2    | 2                                                              | 2   | 3   | 2   | 1   | 2   | 1   | 1   | 1   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 1    | 1    | 2    |
| CO3    | 2                                                              | 3   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 1    | 1    | 2    | 2    | 2    |
| CO4    | 2                                                              | 3   | 1   | 2   | 1   | 2   | 1   | 2   | 1   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 1    |
| CO5    | 2                                                              | 3   | 3   | 2   | 1   | 2   | 1   | 2   | 1   | 2    | 1    | 2    | 1    |      | 1    | 2    | 1    | 3    | 2    | 1    | 2    |

**1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

|                                               |                               |
|-----------------------------------------------|-------------------------------|
| <b>Name &amp; Sign of Program Coordinator</b> | <b>Sign &amp; Seal of HoD</b> |
|-----------------------------------------------|-------------------------------|



## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | ME245                                                                                                                                                                                  | Title of the Course | Fluid Mechanics and Open Channel Hydraulics | L | 2 | T | 0 | P | 1 | C | 3 |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------|---|---|---|---|---|---|---|---|
| Year              | II                                                                                                                                                                                     | Semester            | III                                         |   |   |   |   |   |   |   |   |
| Course Objectives | To make the students acquainted with the behaviour of fluids at rest and in motion and to enable them to apply the principles to design simple fluid mechanical systems in engineering |                     |                                             |   |   |   |   |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                            |
|------------|------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Explain properties of fluids, pressure measurement, and buoyancy principles.                               |
| <b>CO2</b> | Apply fluid flow principles and measuring devices in engineering problems.                                 |
| <b>CO3</b> | Analyze flow through pipes and hydraulic losses.                                                           |
| <b>CO4</b> | Analyze open channel flow and apply dimensional analysis.                                                  |
| <b>CO5</b> | Explain and apply experimental methods to analyze fluid flow, pressure measurement, and hydraulic systems. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Contact Hrs. | Mapped CO |
|----------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Properties of fluids: Ideal and real fluid, units; Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, pressure diagram, application of hydrostatics in engineering structures; Buoyancy, Archimede's principle, metacentre and metacentric height, condition of floatation and stability of submerged and floating bodies.                                                                                                                                                                                                                           | 8            | CO1       |
| 2        | Unit 2            | 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 pitot tube, siphon. Flow through orifices (measurement of discharge, measurement of time), flow through mouthpieces; Flow over notches, flow over weirs, end contraction of rectangular weirs, ventilation of weirs, various types of nappe | 8            | CO2       |
| 3        | Unit 3            | Laminar and turbulent flow in pipes, general equation for head loss Darcy equation, Moody's diagram, minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient, Chezy's formula for loss of head in pipes, flow through simple and compound pipes, transmission of power through pipes.                                                                                                                                                                                                                                                | 8            | CO3       |
| 4        | Unit 4            | Open channel design and hydraulics: Chezy's formula, Bazin's formula, Kutter's, Manning's formula, best hydraulic section, velocity and pressure profiles in open channels, hydraulic jump; Discharge measurement in open channels: current meter. Dimensional analysis and similitude: Rayleigh's method and Buckingham's 'pi' theorem, types of similarities, dimensionless numbers; Introduction to fluid machinery.                                                                                                                                                                                         | 8            | CO4       |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|
| Study of manometers and pressure gauges; Study of transmissibility of liquid pressure; Study of various types of flow such as laminar flow, uniform flow, steady flow, vortex flow, rotational flow; Determination of meta-centric height; Verification of Bernoulli's theorem, determination of coefficient of discharge of venturi-meter and orifice meter; Determination of coefficient of friction in pipeline; Determination of coefficient of discharge for rectangular and triangular notch; Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice; Determination of coefficient of discharge for mouth piece; Determination of efficiency of hydraulic ram; Measurement of velocity by current meter; Study of open channel flow: velocity distribution in open channels and determination of Manning's coefficient of Rugosity and Chezy's roughness coefficient; Study of various types of models and prototypes: geometrical, kinematic and dynamic similarities; Study on non-dimensional constants such as Froude's number and Reynold's number; Study of various types of pumps and its components. | 30 | CO5 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|



## Integral University, Lucknow

### Suggested Readings:

1. Bansal, R. K. 2019. *A Text book of Fluid Mechanics*. Laxmi Publications, New Delhi.
2. Ramanathan, S. 2011. *Hydraulics, Fluid Mechanics & Hydraulic Machines*. Dhanpat Rai & Sons, Delhi.
3. Khurmi, R. S. and Khurmi, N. 1987. *Hydraulics, Fluid Mechanics and Hydraulic Machines*. S. Chand & Co. Ltd., New Delhi.
4. Modi, P. N. and Seth, S. M. 2017. *Hydraulics & Fluid Mechanics including Hydraulic Machines*. Standard Book House, Delhi.

### e-Learning Source:

<https://agrimoon.com/fluid-mechanics-agricultural-engineering-pdf-book/>

<https://mrcet.com/downloads/B.tech%20Digital%20Lecture%20notes/B.Tech%20II%20Year%20I%20Semester/Fluid%20Mechanics%20&%20Hydraulic%20Digital%20Material.pdf>

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                               | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 1   | 3   | 3   | 3   | 2   | 2   | 2   | 1   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 3    | 2    | 1    | 1    | 3    |
| CO2                                                            | 2   | 3   | 3   | 2   | 3   | 2   | 1   | 1   | 1   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 1    | 1    | 2    |
| CO3                                                            | 1   | 3   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 1    | 1    | 2    | 2    | 2    |
| CO4                                                            | 2   | 3   | 1   | 2   | 3   | 2   | 1   | 2   | 1   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 1    | 1    |
| CO5                                                            | 1   | 3   | 3   | 2   | 3   | 2   | 1   | 2   | 1   | 2    | 1    | 2    | 1    |      | 1    | 2    | 1    | 3    | 2    | 1    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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| Name & Sign of Program Coordinator | Sign & Seal of HoD |
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## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE266                                                                                                                                                                                                | Title of the Course | Engineering Properties of Agricultural Produce and Food Science | L | 2 | T | 0 | P | 1 | C | 3 |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------|---|---|---|---|---|---|---|---|
| Year              | II                                                                                                                                                                                                   | Semester            | III                                                             |   |   |   |   |   |   |   |   |
| Course Objectives | To make the students acquainted with the different engineering properties of agricultural produce and to help them understand the importance of these properties in handling, processing and storage |                     |                                                                 |   |   |   |   |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                           |
|------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Explain engineering and physical properties of food materials.                                                            |
| <b>CO2</b> | Apply thermal, electrical, and frictional properties in food processing.                                                  |
| <b>CO3</b> | Analyze rheological and quality characteristics of food materials.                                                        |
| <b>CO4</b> | Explain food preservation, spoilage, and microbiological aspects.                                                         |
| <b>CO5</b> | Understand and apply experimental techniques to determine engineering, thermal, and quality properties of food materials. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Contact Hrs. | Mapped CO |
|----------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Different engineering properties of food and their importance; Application of engineering properties in handling, processing and storage; Physical properties, viz. shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area; Colour properties, CIE colour model.                                                                                                                                                                                                                              | 6            | CO1       |
| 2        | Unit 2            | Thermal properties, viz. heat capacity, specific heat, thermal conductivity, thermal diffusivity, heat of respiration, co-efficient of thermal expansion; Electrical and dielectric properties as resistance, capacitance, dielectric loss factor, loss tangent, and dielectric constant; Frictional properties, viz. static friction, kinetic friction, rolling resistance, angle of internal friction, angle of repose, flow of bulk granular materials; Aero-dynamic characteristics such as drag coefficient, terminal velocity. | 10           | CO2       |
| 3        | Unit 3            | Rheological characteristics of food, elastic, plastic and viscous behaviour, visco-elasticity; rheological models to explain food characteristics; Fluid behaviour as Newtonian, non-Newtonian, pseudo-plastic, dilatant, thixotropic, rheopectic and Bingham plastic; Textural characteristics of foods. Non-destructive methods of quality determination of foods; Principles of machine vision systems, spectroscopy, hyperspectral imaging and acoustic techniques.                                                              | 8            | CO3       |
| 4        | Unit 4            | Introduction to food science and food technology; Biochemical reactions involved in food processing and storage; Food spoilage agents, general methods for food preservation (physical, chemical and biological methods); Food microbiology: Classification of microorganisms, multiplication of bacteria, Different beneficial and harmful microorganisms in relation to food preservation and spoilage, industrial bacteriology and food fermentation.                                                                             | 8            | CO4       |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|
| Determination of the size of grains, fruits and vegetables using measuring instruments and using projection system; Determination of the shape (sphericity and roundness); Determination of the bulk and particle volume, bulk and particle density, specific gravity and porosity of grains; Determination of the volume, density and specific gravity of large individual objects (F and V); Determination of the surface area of the F and V; Determination of angle of repose, co-efficient of friction of different grains on different surfaces and angle of internal friction; To study the terminal velocity of grains and separating behavior of grains in a vertical wind tunnel; Determination of specific heat and thermal conductivity of some food grains; Determination of electrical properties of food materials; Determination of hardness of food materials; Determination of viscosity of food; Study and comparison of colour of food materials; Determination of carbohydrates; Determination of total nitrogen; Determination of oil content; Determination of ash content; Study of different types of microorganisms and microbiological examination of food products. | 30 | CO5 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|



## Integral University, Lucknow

### Suggested Readings:

1. Mohesin, N. N. 1980. *Physical Properties of Plants & Animals*. Gordon & Breach Science Publishers, New York.
2. Rao, M. A. and Rizvi, S. H. 1995. *Engineering Properties of Foods*. Marcel Dekker Inc. New York.
3. Serpil, S. and Servet, G. S. 2005. *Physical Properties of Foods*. Springer Science+Business Media, LLC, 233 Spring Street, New York.
4. Singhal, O. P. and Samuel, D. V. K. 2003. *Engineering Properties of Biological Materials*. Saroj Prakasan, New Delhi.

### e-Learning Source:

<https://bbsbec.edu.in/wp-content/uploads/2020/01/EngineeringPropertiesofAgriculturalFoodMaterials-converted-converted.pdf>

| PO-<br>PSO<br>CO | Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
|                  | PO1                                                            | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1              | 1                                                              | 3   | 3   | 3   | 2   | 2   | 2   | 3   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 3    | 2    | 1    | 3    | 1    |
| CO2              | 2                                                              | 2   | 3   | 2   | 3   | 2   | 1   | 3   | 1   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 1    | 2    | 2    |
| CO3              | 1                                                              | 2   | 2   | 2   | 2   | 2   | 2   | 3   | 2   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 1    | 1    | 2    | 2    | 2    |
| CO4              | 2                                                              | 2   | 1   | 2   | 3   | 2   | 1   | 3   | 1   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 2    | 1    |
| CO5              | 1                                                              | 2   | 3   | 2   | 3   | 2   | 1   | 3   | 1   | 2    | 1    | 2    | 1    | 2    | 1    | 2    | 1    | 3    | 2    | 2    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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| Name & Sign of Program Coordinator | Sign & Seal of HoD |
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## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE267                                                                                                                                                                                                                                          | Title of the Course | Farm Machinery and Equipment- I | L | T | P | C |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------|---|---|---|---|
| Year              | II                                                                                                                                                                                                                                             | Semester            | III                             | 2 | 0 | 1 | 3 |
| Course Objectives | To make the students acquainted with the basic construction and operational features of different farm machineries used in operations such as seed-bed preparation, sowing, planting and transplanting, etc., and their economics of operation |                     |                                 |   |   |   |   |

| Course Outcomes<br>Students will be able to |                                                                                                             |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| CO1                                         | Explain concepts of farm mechanization, machine classification, and materials used.                         |
| CO2                                         | Apply knowledge of tillage machinery and their components in field operations.                              |
| CO3                                         | Apply calculations for field capacity, power requirement, and machinery economics.                          |
| CO4                                         | Analyze sowing and planting equipment performance and calibration methods.                                  |
| CO5                                         | Explain operation, calibration, and evaluation of farm machinery and implements used in tillage and sowing. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Contact Hrs. | Mapped CO |
|----------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Introduction to farm mechanization; Classification of farm machines; Unit operations in crop production; Identification and selection of machines for various operations on the farm. Materials used in construction of farm machines; Heat treatment processes and their use in farm machines; Properties of materials used for critical and functional components of agricultural machines                                                                                                                                                                                                  | 8            | CO1       |
| 2        | Unit 2            | Different types of steels and alloys for agricultural applications; Identification of heat treatment processes specially for the agricultural machinery components. Seed-bed preparation and its classification; Land reclamation and earth moving equipment; Machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage, viz. mould-board plough, disc plough, chisel plough, sub-soiler, harrows, puddler, cultivators, identification of their major functional components; Attachments with tillage machinery; Hitching systems and controls. | 10           | CO2       |
| 3        | Unit 3            | Calculation of field capacities and field efficiency; Draft of tillage tools and calculations for power requirement for the tillage machines; Calculation for economics of machinery usage; Comparison of ownership with hiring of machines.                                                                                                                                                                                                                                                                                                                                                  | 6            | CO3       |
| 4        | Unit 4            | Sowing, planting and transplanting equipment, viz. seed drills, no-till drills, strip-till drills, different types of planters, bed-planters; Planting equipment for crops like sugarcane, potato; Furrow openers and metering systems in drills and planters; Calibration of seed-drills/ planters; Adjustments during operation. Testing and Evaluation of tillage and sowing equipment and their test codes                                                                                                                                                                                | 8            | CO4       |

| Practical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |    |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|----|-----|
| Familiarization with different farm implements and tools; Study of hitching systems; Study on draft measurement; Study of different problems on machinery management.; Study of primary tillage machinery- types, construction, operation, adjustments and calculations of power and draft requirements; Study of secondary tillage machinery- types, construction, operation, adjustments and calculations of power and draft requirements; Study of different types of puddlers and determination of puddling index in the field; Study of sowing and planting equipment- construction, types, calculation for calibration and adjustments; Study of seed drill and its calibration; Study of different types of metering mechanisms used in seed drills and planters; Study of paddy transplanters; Study of various pre-germinated paddy seeder; Study of vegetable transplanters; Identification of materials of construction in agricultural machinery and study of material properties; Testing and Evaluation of tillage and sowing equipment; Visit to a site to observe field operations of paddy transplanters; Visit to an implement manufacturing unit. |  |  | 30 | CO5 |



## Integral University, Lucknow

### Suggested Readings:

1. Jain, S. C. and Phillips, G. 2003. *Farm Machinery - An Approach*. Standard Publishers and Distributors.
2. Kepner, R. A., Bainer, R. and Barger, E. L. 2005. *Principles of Farm Machinery*. CBS Publishers and Distributors.
3. Lal, Radhey and Datta, A. C. 1978. *Agricultural Engineering through worked out examples*. Saroj Prakashan, Allahabad.

### e-Learning Source:

<https://agrimoon.com/wp-content/uploads/Farm-Machinery-and-Equipment-I.pdf>

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-PSO<br>CO                                                   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 1   | 3   | 1   | 3   | 2   | 2   | 3   | 1   | 3   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 3    | 2    | 1    | 3    | 1    |
| CO2                                                            | 2   | 2   | 2   | 2   | 3   | 2   | 3   | 1   | 3   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 1    | 2    | 2    |
| CO3                                                            | 1   | 2   | 1   | 2   | 2   | 2   | 3   | 2   | 3   | 2    | 2    | 2    | 2    | 1    | 1    | 2    | 1    | 1    | 2    | 2    | 2    |
| CO4                                                            | 2   | 2   | 1   | 2   | 3   | 2   | 3   | 2   | 3   | 1    | 1    | 2    | 1    | 1    | 1    | 2    | 1    | 3    | 2    | 2    | 1    |
| CO5                                                            | 1   | 2   | 2   | 2   | 3   | 2   | 3   | 2   | 3   | 2    | 1    | 2    | 1    |      | 1    | 2    | 1    | 3    | 2    | 2    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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| Name & Sign of Program Coordinator | Sign & Seal of HoD |
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## Integral University, Lucknow

|                                          |                                                                                                                                                                                                                                                  |                            |                                                              |          |          |          |          |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------|----------|----------|----------|----------|
| <b>Effective from Session:</b> 2026-2027 |                                                                                                                                                                                                                                                  |                            |                                                              |          |          |          |          |
| <b>Course Code</b>                       | AG246                                                                                                                                                                                                                                            | <b>Title of the Course</b> | Physical Education, First Aid, Yoga Practices and Meditation | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>Year</b>                              | <b>II</b>                                                                                                                                                                                                                                        | <b>Semester</b>            | III                                                          | <b>1</b> | <b>0</b> | <b>1</b> | <b>2</b> |
| <b>Course Objectives</b>                 | 1. To make the students aware about Physical Education, First Aid and Yoga Practices.<br>2. To disseminate the knowledge and skill how to perform physical training, perform first aid and increase stamina and general well being through yoga. |                            |                                                              |          |          |          |          |

|                                                    |                                                                                                                                                                             |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course Outcomes</b><br>Students will be able to |                                                                                                                                                                             |
| <b>CO1</b>                                         | Understand the concepts, principles, history, and scope of natural farming along with its role in climate change mitigation, soil health, and sustainability.               |
| <b>CO2</b>                                         | Explain the pillars, models, and ecological foundations of natural farming including farm design, ecosystem services, and integrated farming approaches.                    |
| <b>CO3</b>                                         | Explain the pillars, models, and ecological foundations of natural farming including farm design, ecosystem services, and integrated farming approaches.                    |
| <b>CO4</b>                                         | Analyze government initiatives, case studies, and entrepreneurial opportunities in natural and chemical-free farming systems.                                               |
| <b>CO5</b>                                         | Demonstrate practical skills in natural farming techniques including on-farm input preparation, seed production, ecosystem evaluation, and farm-level management practices. |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Practical</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
| <p>Physical education; Training and Coaching - Meaning and Concept; Methods of Training; aerobic and aerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory and Digestive systems; Balanced Diet and Nutrition: Effects of Diet on Performance; Physiological changes due to ageing and role of regular exercise on ageing process; Personality, its dimensions and types; Role of sports in personality development; Motivation and Achievements in Sports; Learning and Theories of learning; Adolescent Problems and its Management; Posture; Postural Deformities; Exercises for good posture.</p> <p>Yoga; History of Yoga, Types of Yoga, Introduction to Yoga:</p> <ul style="list-style-type: none"> <li>• Asanas: Definition and Importance, Padmasan, Gaumukhasan, Bhadrasan, Vajrasana, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardha Chandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasana, Patangasan, Shishupalanasana– left leg right leg, Pawanmuktasan, Halasana, Sarpasana, Ardha Dhanurasana, Sawasana</li> <li>• Suryanamskara Pranayama (Definition and Importance) Omkar, Surya Bhedana, Chandrabhedana, Anulom Viloma, Shitali, Shitkari, Bhastrika, Bhramari</li> <li>• Meditation (Definition and Importance), Yogic Kriyas (Kapalbhati), Tratak, Jalneti and Tribandha</li> <li>• Mudras (Definition and Importance) Gyanmudra, Dhyana mudra, Vayumudra, Akashmudra, Pruthvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, Uddanamudra</li> <li>• Role of yoga in sports</li> <li>• Teaching of Asanas – demonstration, practice, correction and practice. History of sports and ancient games, Governance of sports in India; Important national sporting events; Awards in Sports; History, latest rules, measurements of playfield, specifications of equipment, skill, technique, style and coaching of major games (Cricket, football, table Tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho) and Athletics Need and requirement of first aid. First Aid equipment and upkeep.</li> </ul> <p>First AID Techniques, First aid related with respiratory system. First aid related with Heart, Blood and Circulation. First aid related with Wounds and Injuries. First aid related with Bones, Joints Muscle related injuries. First aid related with Nervous system and Unconsciousness. First aid related with Gastrointestinal Tract. First aid related with Skin, Burns. First aid related with Poisoning. First aid related with Bites and Stings. First aid related with Sense organs, Handling and transport of injured traumatized persons. Sports injuries and their treatments.</p> | 30 |

|                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Suggested Readings:</b>                                                                                                                                                                                                                                                                                                                                                           |
| Physical Education, First Aid and Yoga Practices - by Ramakant D. Bansode Publisher : Khel Sahitya Kendra<br>Physical Education, First Aid, Yoga Practices & Meditation (Sixth Dean, ICAR). Gyanavi Publishers & Distributors                                                                                                                                                        |
| <b>e-Learning Source:</b>                                                                                                                                                                                                                                                                                                                                                            |
| <a href="https://muslimcollegeofeducation.in/pdf/YOGA-AND-PHYSICAL-EDUCATION.pdf">https://muslimcollegeofeducation.in/pdf/YOGA-AND-PHYSICAL-EDUCATION.pdf</a><br><a href="https://www.slideshare.net/slideshow/2-semester-iv-unit-ii-notes-for-yoga-first-aid-pptx/269527110">https://www.slideshare.net/slideshow/2-semester-iv-unit-ii-notes-for-yoga-first-aid-pptx/269527110</a> |



## Integral University, Lucknow

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                               | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1                                                            | 3   | 2   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1    | 1    | 3    | 3    | 2    | 1    |
| 2CO2                                                           | 3   | 3   | 1   | 2   | 1   | 1   | 1   | 1   | 1   | 2    | 1    | 3    | 3    | 3    | 2    |
| CO3                                                            | 3   | 3   | 1   | 2   | 2   | 1   | 1   | 1   | 1   | 1    | 1    | 3    | 3    | 3    | 3    |
| CO4                                                            | 2   | 2   | 1   | 2   | 1   | 1   | 1   | 2   | 2   | 1    | 1    | 3    | 2    | 2    | 2    |
| CO5                                                            | 3   | 3   | 1   | 3   | 3   | 1   | 1   | 2   | 2   | 1    | 1    | 3    | 3    | 3    | 3    |

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

|                                    |                    |
|------------------------------------|--------------------|
| Name & Sign of Program Coordinator | Sign & Seal of HoD |
|------------------------------------|--------------------|



## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | MT249                                                                                                                                                                                                   | Title of the Course | Engineering Mathematics-II | L | 3 | T | 0 | P | 0 | C | 3 |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------|---|---|---|---|---|---|---|---|
| Year              | II                                                                                                                                                                                                      | Semester            | IV                         |   |   |   |   |   |   |   |   |
| Course Objectives | To make the students acquainted with the application of various advanced mathematics such as vector calculus, Fourier series and Laplace transform and applications of numerical methods in engineering |                     |                            |   |   |   |   |   |   |   |   |

### Course Outcomes

Students will be able to

| CO1 | Define and recall fundamental concepts of vector calculus and complex variables including gradient, divergence, curl, line/surface integrals, and Cauchy-Riemann equations.           |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO2 | Explain the principles of Fourier series and Laplace transforms and interpret their applications in solving ordinary and simultaneous differential equations.                         |
| CO3 | Apply numerical methods such as finite difference operators and interpolation techniques (Newton's forward, backward, and divided difference) to solve practical problems.            |
| CO4 | Analyze and compare numerical techniques including Lagrange interpolation, numerical differentiation/integration, and methods for solving ODEs such as Euler and Runge-Kutta methods. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                | Contact Hrs. | Mapped CO |
|----------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Vector calculus: Scalar and vector point functions, vector differential operator Del, gradient of scalar point function, divergent and curl of vector point function and their physical interpretations, line, surface and volume integrals, Green's, Stock's and Divergence theorem (without proofs), functions of a complex variable, limit, continuity and analytic function, Cauchy-Reimann equations, harmonic functions. | 10           | CO1       |
| 2        | Unit 2            | Fourier series: Periodic functions, Euler's formulae, functions having arbitrary period, even and odd functions, half range series expansion, series expansion of functions with finite discontinuity; Laplace Transform: rules for Laplace transform and inverse Laplace transform, applications to find solutions of ordinary and simultaneous differential equations.                                                       | 10           | CO 2      |
| 3        | Unit 3            | Numerical methods: Finite difference operators and their relationship, factorial notation. Newton's forward and backward interpolation formula, Newton's divide difference interpolation.                                                                                                                                                                                                                                      | 9            | CO 3      |
| 4        | Unit 4            | Lagrange's interpolation formula, numerical differentiation and integration rule, numerical solutions of ODE by Taylor's series, Euler's and modified Euler's method, Runge-Kutta method of order four.                                                                                                                                                                                                                        | 10           | CO 4      |

### Suggested Readings:

1. Grewal, B S. 2004. *Higher Engineering Mathematics*. Khanna Publishers Delhi.
2. Narayan, S. 2004. *A Text Book of Vector*. S. Chand and Co. Ltd., New Delhi.
3. Narayan, S. 2004. *Differential Calculus*. S. Chand and Co. Ltd., New Delhi.
4. Narayan, S. 2004. *Integral Calculus*. S. Chand and Co. Ltd. New Delhi.
5. Ramana, B. V. 2008. *Engineering Mathematics*. Tata McGraw-Hill, New Delhi.

### e-Learning Source:

[https://mrcet.com/downloads/digital\\_notes/HS/R-18%20Mathematics-II.pdf](https://mrcet.com/downloads/digital_notes/HS/R-18%20Mathematics-II.pdf)

<https://agrimoon.com/agricultural-engineering-icar-ecourse-pdf-books-free-download/>

|              | Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |  |
|--------------|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|--|
| PO-PSO<br>CO | PO1                                                            | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |  |
| CO1          | 3                                                              | 2   | 2   | 3   | 3   | 2   | 3   | 2   | 3   | 2    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3    | 2    | 3    | 2    |  |
| CO2          | 3                                                              | 3   | 2   | 2   | 2   | 2   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 2    |  |
| CO3          | 2                                                              | 3   | 1   | 3   | 2   | 3   | 3   | 3   | 2   | 2    | 2    | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 3    | 2    | 3    |  |
| CO4          | 3                                                              | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 1   | 2    | 3    | 3    | 1    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 2    |  |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



## Integral University, Lucknow

|                                               |                               |
|-----------------------------------------------|-------------------------------|
| <b>Name &amp; Sign of Program Coordinator</b> | <b>Sign &amp; Seal of HoD</b> |
|-----------------------------------------------|-------------------------------|



## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE269                                                                                                                                           | Title of the Course | Theory of Structures | L | T | P | C |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------|---|---|---|---|
| Year              | II                                                                                                                                              | Semester            | IV                   | 1 | 0 | 1 | 2 |
| Course Objectives | To make the students acquainted with the principles of structural design and to enable them to design small and medium RCC and steel structures |                     |                      |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                                                                                                                                                      |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand and recall different types of loads, relevant IS 800:2007 steel design code provisions, and basic specifications for steel structure design.                                                                                              |
| <b>CO2</b> | Apply principles of structural design to analyze and design steel members under tension, compression, and bending, and utilize software tools like STAAD.Pro structural analysis software or ETABS structural design software for roof truss design. |
| <b>CO3</b> | Analyze RCC structural elements using IS 456:2000 concrete design code provisions and evaluate the behavior of singly and doubly reinforced sections and beams.                                                                                      |
| <b>CO4</b> | Evaluate and design slabs, columns, and foundations, and assess design considerations for retaining walls and silos using standard codes and software tools.                                                                                         |
| <b>CO5</b> | Design and develop detailed drawings of steel roof trusses and RCC building components (beams, slabs, columns, and foundations) using appropriate design procedures and software applications.                                                       |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                      | Contact Hrs. | Mapped CO |
|----------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | <b>Unit 1</b>     | Types of Load and use of BIS code, Design of steel structures: Specifications, use of IS code (IS 800-2007) and steel table.                                         | 5            | CO1       |
| 2        | <b>Unit 2</b>     | Design of steel sections under tension, compression and bending, use of any one design software such as Staad Pro, ETABS, etc. for design of roof truss.             | 5            | CO 2      |
| 3        | <b>Unit 3</b>     | Design of RCC structures: Specifications, use of IS code (IS 456-2000), analysis and design of singly and doubly reinforced sections, design of beams.               | 5            | CO 3      |
| 4        | <b>Unit 4</b>     | Design of one way and two-way slabs, columns and foundations, design considerations for retaining walls and silos, use of design software for simple RCC structures. | 3            | CO 4      |

### Practical

|                                                                                                                                                                                                                                                                                                                                                |    |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|
| Design and drawing of steel roof truss including tension member, compression member, and member under bending; use of design softwares; Design and drawing of RCC building, including single reinforced beam, double reinforced beam, one-way slab, two-way slabs, columns and foundations; use of design softwares for simple RCC structures. | 30 | CO 5 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|

### Suggested Readings:

1. Bhavikatti, S. S. 2014. *Design of Steel Structures: By Limit State Method as Per IS: 800-2007*. I K International Publishing House Pvt. Ltd.
2. Duggal, S. K. 2017. *Limit State Design of Steel Structures*. McGraw Hill Education.
3. Punmia, B. C., Jain, A. K. and Jain, A. K. 2016. *Limit State Design of Reinforced Concrete*. Laxmi Publications.
4. Raju, N. K. 2019. *Design of Reinforced Concrete Structures: IS:456-2000*. CBS Publishers & Distributors

### e-Learning Source:

<https://agrimoon.com/agricultural-engineering-icar-ecourse-pdf-books-free-download/>

<https://agrimoon.com/design-of-structures-pdf-book/>

| Course Articulation Matrix: (Mapping of COs with POs and PSO) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                              | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                           | 2   | 3   | 3   | 3   | 3   | 2   | 3   | 2   | 3   | 2    | 3    | 3    | 3    | 3    | 2    | 2    | 3    | 3    | 2    | 3    | 3    |
| CO2                                                           | 3   | 3   | 2   | 2   | 1   | 2   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 2    |
| CO3                                                           | 3   | 3   | 1   | 3   | 2   | 3   | 3   | 3   | 2   | 3    | 2    | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 3    | 2    | 3    |
| CO4                                                           | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 1   | 2    | 3    | 3    | 1    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 2    |



**1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

|                                               |                               |
|-----------------------------------------------|-------------------------------|
| <b>Name &amp; Sign of Program Coordinator</b> | <b>Sign &amp; Seal of HoD</b> |
|-----------------------------------------------|-------------------------------|



## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE270                                                                                                                                                            | Title of the Course | Building Construction and Cost Estimation | L | 2 | T | 0 | P | 0 | C | 2 |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------|---|---|---|---|---|---|---|---|
| Year              | II                                                                                                                                                               | Semester            | IV                                        |   |   |   |   |   |   |   |   |
| Course Objectives | To make the students acquainted with the methods of construction of agricultural buildings and to enable them to prepare various types of estimates of buildings |                     |                                           |   |   |   |   |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                                                                                                              |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Recall and describe the properties, types, and uses of various building materials such as stones, bricks, tiles, lime, and cement, along with their manufacturing processes.                                 |
| <b>CO2</b> | Explain the properties and applications of concrete, ferrous and non-ferrous materials, timber, and other building materials, and apply appropriate material selection principles in construction practices. |
| <b>CO3</b> | Analyze building components and construction techniques including foundations, masonry, roofing, flooring, damp proofing, and finishing methods for different types of buildings.                            |
| <b>CO4</b> | Evaluate and prepare detailed cost estimates of buildings using standard procedures, and develop cost-effective solutions through economic analysis methods such as benefit-cost ratio and payback period.   |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                | Contact Hrs. | Mapped CO |
|----------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Building materials: Description of important building materials, rocks, different stones; formation of stones, types of stones, quarrying process, stone products and uses; Bricks, types, preparation and burning of bricks, properties and uses; Tiles, types and classification; Lime, properties and uses, cement, different uses and grades.                                                              | 5            | CO1       |
| 2        | Unit 2            | Concrete: Grades, preparation, mixing and laying of concrete, use of sand; Use of ferrous material, iron and steel products; Use of non-ferrous metals, glass, rubber, plastics, aluminum, copper, nickel; Timber and its uses, seasoning, defects, commercial form of timber, miscellaneous building materials.                                                                                               | 4            | CO 2      |
| 3        | Unit 3            | Building construction: Building components, foundations, brick work, lintels, columns, roofs and stair cases, different types of floors, plastering and pointing, damp proofing and waterproofing, white washing, distempering and painting, steps for building construction, needs of different agricultural buildings, types and uses, types of roofs, slope and flat roof buildings.                        | 5            | CO 3      |
| 4        | Unit 4            | Estimating and costing: Types of estimates, rough cost, detailed and supplementary estimate, preparation of cost estimate, cost analysis, schedule of rates, analysis of rates, factors affecting building costs, building codes, estate development. Cost economics: Measurement and pricing, economic methods for evaluation of buildings, benefit cost calculation, rate of return period (payback period). | 5            | CO 4      |

### Suggested Readings:

1. Duggal, S. K. 2012. *Building Material*. New Age International Publishers.
2. Dutta, B. N. 2000. *Estimating and Costing*. UBS publishers.
3. Punmia, B. C., Jain, A. K. and Jain, A. K. 1984. *Building Construction*. Laxmi Publications (P) Ltd., New Delhi.
4. Rangwala, S. C. 1994. *Engineering Materials*. Charotar Publishing House, Anand.

### e-Learning Source:

<https://www.scribd.com/document/820697977/BCCE>  
<https://www.nrtec.in/wp-content/uploads/2023/08/ESC-Notes.pdf>

|              | Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|--------------|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-PSO<br>CO | PO1                                                            | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1          | 3                                                              | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 3   | 2    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3    | 2    | 3    | 1    |
| CO2          | 3                                                              | 3   | 2   | 2   | 1   | 2   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 2    |



## Integral University, Lucknow

|     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C03 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| C04 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

|                                               |                               |
|-----------------------------------------------|-------------------------------|
| <b>Name &amp; Sign of Program Coordinator</b> | <b>Sign &amp; Seal of HoD</b> |
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## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE271                                                                                                                                                                                                                                   | Title of the Course | Watershed Hydrology | L | T | P | C |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---|---|---|---|
| Year              | II                                                                                                                                                                                                                                      | Semester            | IV                  | 2 | 0 | 1 | 3 |
| Course Objectives | To make the students acquainted with the different hydrological processes, their methods of analysis so as to enable them to apply these for watershed development, water harvesting, minor irrigation, drought and flood control, etc. |                     |                     |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                                                                                                               |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Recall and describe components of the hydrologic cycle, forms of precipitation, rainfall measurement techniques, and concepts such as mass curve, hyetograph, and intensity-duration-frequency relationships. |
| <b>CO2</b> | Explain hydrologic processes including interception, infiltration, evaporation, and runoff, and apply appropriate methods (Rational, Cook's, and SCS Curve Number) to estimate runoff and peak discharge.     |
| <b>CO3</b> | Analyze watershed characteristics using geomorphological parameters and evaluate hydrographs, including base flow separation and unit hydrograph theory for runoff estimation.                                |
| <b>CO4</b> | Evaluate flood routing techniques, drought classification, and management strategies, and assess hydrologic behavior in dryland regions under varying climatic conditions.                                    |
| <b>CO5</b> | Develop and perform hydrological analyses through field observations and computations, including rainfall data analysis, runoff estimation, hydrograph development, and application of hydrologic models.     |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                         | Contact Hrs. | Mapped CO |
|----------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Hydrologic cycle, components; Precipitation and its forms, rainfall measurement and estimation of mean rainfall, estimation of missing rainfall, optimum number of rain gauges. Frequency analysis of point rainfall; Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship. | 8            | CO1       |
| 2        | Unit 2            | Hydrologic processes- interception, infiltration -factors influencing, measurement and indices; Evaporation- estimation and measurement; Runoff-factors affecting, measurement, stage - discharge rating curve, estimation of peak runoff rate and volume, rational method, Cook's method and SCS curve number method.  | 8            | CO 2      |
| 3        | Unit 3            | 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.                                                  | 8            | CO 3      |
| 4        | Unit 4            | Flood routing – channel and reservoir routing; Hydrology of dry land areas, Troll's climatic classification; Drought- classification, causes and impacts, drought management strategy.                                                                                                                                  | 7            | CO 4      |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|
| Visit to meteorological observatory and study of different instruments; Study of optimal rain gauge network; Study of intensity - frequency - duration curves; Study of depth - area – duration curve; Analysis of rainfall data and estimation of mean rainfall by different methods; Analysis of frequency of hydrologic data and estimation of missing data, test for consistency of rainfall records; Computation of infiltration indices; Computation of peak runoff and runoff volume by Cook's method and rational formula; Computation of runoff volume by SCS curve number method; Study of stream gauging instruments- current meter and stage level recorder; Study and determination of geomorphic parameters of watersheds; Study of runoff hydrograph and separation of base flow and surface flow ; Study of unit hydrograph; Study of synthetic hydrograph; Study of flood routing; Study of various discharge measuring devices. | 30 | CO 5 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|



## Integral University, Lucknow

### Suggested Readings:

1. Chow, V. T., Maidment, D. R. and Mays, L. W. 2010. *Applied Hydrology*. McGraw Hill, New York.
2. Das, G. 2000. *Hydrology and Soil Conservation Engineering*. PHI, New Delhi.
3. Garg, S. K. 1998. *Hydrology and Water Resources Engineering*. Khanna Publishers, Delhi.
4. Jaya Rami Reddy, P. 2011. *A Text Book of Hydrology*. University Science Press, New Delhi.
5. Linsley, R. K., Kohler, M. A., and Paulhus, J. L. H. 1984. *Hydrology for Engineers*. McGraw-Hill Publishing Co., Japan.

### e-Learning Source:

[https://www.rpcau.ac.in/wp-content/uploads/2020/03/SWC-201\\_Watershed-Hydrology\\_All-lectures.pdf](https://www.rpcau.ac.in/wp-content/uploads/2020/03/SWC-201_Watershed-Hydrology_All-lectures.pdf)

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                               | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 2   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 3   | 2    | 3    | 3    | 3    | 2    | 3    | 2    | 3    | 3    | 2    | 1    | 2    |
| CO2                                                            | 3   | 3   | 2   | 2   | 1   | 2   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 2    |
| CO3                                                            | 2   | 2   | 1   | 3   | 2   | 3   | 3   | 3   | 2   | 3    | 2    | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 3    | 3    | 3    |
| CO4                                                            | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 1   | 2    | 3    | 3    | 1    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 2    |
| CO5                                                            | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | 1    | 3    | 2    | 3    | 3    | 2    | 3    | 3    | 3    | 2    | 3    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

|                                    |                    |
|------------------------------------|--------------------|
| Name & Sign of Program Coordinator | Sign & Seal of HoD |
|------------------------------------|--------------------|



## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE272                                                                                                                                               | Title of the Course | Soil and Water Conservation Engineering | L | 2 | T | 0 | P | 1 | C | 3 |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------|---|---|---|---|---|---|---|---|
| Year              | II                                                                                                                                                  | Semester            | IV                                      |   |   |   |   |   |   |   |   |
| Course Objectives | To make the students acquainted with the different causes of soil erosion and water loss and the different measures for soil and water conservation |                     |                                         |   |   |   |   |   |   |   |   |

### Course Outcomes

Students will be able to

| CO1 | Recall and describe the causes, types, and mechanics of soil erosion, including water erosion forms, gully development stages, and concepts of soil loss estimation using USLE.                                                          |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO2 | Explain various agronomical and engineering measures for controlling water erosion and apply design principles for bunds, terraces, waterways, and hydraulic structures based on energy and momentum concepts.                           |
| CO3 | Analyze the design and functional requirements of soil conservation structures such as check dams and spillways, and evaluate factors influencing wind erosion, sedimentation, and land capability classification.                       |
| CO4 | Evaluate different water harvesting techniques and structures, including farm ponds, tanks, and percolation ponds, and assess their design, site suitability, and effectiveness in water conservation.                                   |
| CO5 | Design and develop soil and water conservation plans through estimation of soil loss, sedimentation analysis, and hydraulic and structural design of conservation and water harvesting structures using standard methods and field data. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Contact Hrs. | Mapped CO |
|----------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | 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 samples.                                                                                                                                                     | 8            | CO1       |
| 2        | Unit 2            | 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 stone wall and trenching; Gully and ravine reclamation- principles of gully control, vegetative measures, temporary structures and diversion drains. Grassed waterways and design. Energy and momentum principles in open channels; specific energy and specific force, hydraulic jump and its application, types of hydraulic jump, energy dissipation due to the jump. | 8            | CO 2      |
| 3        | Unit 3            | Soil erosion control structures- Introduction, classification and functional requirements. Permanent structures for soil conservation and gully control- check dams, drop, chute and drop inlet spillways- design requirements, planning for design, design procedures- hydrologic, hydraulic and structural design and stability analysis. 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, dryland farming; Rate of sedimentation, silt monitoring and storage loss in tanks, control of sedimentation in reservoirs.                                     | 8            | CO 3      |
| 4        | Unit 4            | Water harvesting techniques: Classification based on source, storage and use, runoff harvestingshort- term and long-term techniques; Structures- farm ponds - dug-out and embankment reservoir types, tanks and subsurface dykes; Farm pond- components, site selection, design criteria, capacity, embankment, mechanical and emergency spillways, cost estimation and construction; Percolation pond - site selection, design and construction details. Design considerations of <i>nala</i> bunds.                                                                                                                                                                                                                              | 7            | CO 4      |

**Practical**



## Integral University, Lucknow

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|
| Estimation of soil loss by USLE, computation of rainfall erosivity index, computation of soil erodibility index in soil loss estimation; Determination of length of slope (LS) and cropping practice (CP) factors; Estimation/measuring techniques of soil loss; Study of rainfall simulator for erosion assessment, estimation of sediment rate using Coshocton wheel sampler and multi-slot devisor; Determination of sediment concentration through oven drying method. Calculation of rate of sedimentation and storage loss in tanks; Study on sedimentation of reservoirs; Design and layout of contour bunds and graded bunds; Design and layout of broad base terraces and bench terraces; Design of vegetative waterways; Design of shelter belts and wind breaks for wind erosion control; Farm pond- design, capacity and estimation; Hydraulic design of drop spillway; Determination of uplift force and construction of uplift pressure diagram, structural design and stability analysis of drop spillway; Hydraulic and structural design of chute spillway, design of SAF energy dissipater; Design of drop inlet spillway; Study on components of earth embankments and its design; Design of water harvesting structures; Study on prioritization of watershed; Visit to soil erosion sites and watershed project areas for studying erosion control and water conservation measures; Visit to a watershed | 30 | CO 5 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|

### Suggested Readings:

1. Chow, V. T. 1985. *Open-Channel Hydraulics*. McGraw- Hill Book Company, Inc.
2. Frevert, R. K., Schwab, G. O., Edminster, T. W. and Barnes, K. K. 2009. *Soil and Water Conservation Engineering*. 4th Edition, John Wiley and Sons, New York.
3. Mahnot, S. C. 2014. *Soil and Water Conservation and Watershed Management*. International Books and Periodicals Supply Service, New Delhi.

### e-Learning Source:

<https://agrimoon.com/wp-content/uploads/Soil-and-Water-Conservation-Engineering.pdf>

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                               | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 2   | 3   | 3   | 2   | 3   | 2   | 2   | 2   | 3   | 2    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3    | 2    | 3    | 2    |
| CO2                                                            | 3   | 3   | 2   | 2   | 1   | 2   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 3    |
| CO3                                                            | 2   | 3   | 1   | 3   | 2   | 3   | 3   | 3   | 2   | 3    | 2    | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 3    | 2    | 3    |
| CO4                                                            | 3   | 2   | 3   | 3   | 3   | 2   | 2   | 2   | 1   | 2    | 3    | 3    | 1    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 2    |
| CO5                                                            | 2   | 3   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | 2    | 3    | 2    | 3    | 2    | 2    | 3    | 2    | 2    | 1    | 3    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

|                                    |                    |
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| Name & Sign of Program Coordinator | Sign & Seal of HoD |
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## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE273                                                                                                                                                                                                                                            | Title of the Course | Farm Machinery and Equipment II | L | T | P | C |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------|---|---|---|---|
| Year              | II                                                                                                                                                                                                                                               | Semester            | IV                              | 2 | 0 | 1 | 3 |
| Course Objectives | To make the students acquainted with the basic construction and operational features, and economics of operation of different farm machineries used in operations such as weeding, harvesting, etc., including operations done by combines, etc. |                     |                                 |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                                                                                                                      |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Recall and describe different types of plant protection equipment, sprayers, dusters, nozzles, weeders, and fertilizer application equipment along with their components and functions.                              |
| <b>CO2</b> | Explain principles of crop harvesting systems and apply operational knowledge for mowers, reapers, binders, and hay conditioning methods, including moisture content calculations.                                   |
| <b>CO3</b> | Analyze threshing systems, grain combines, and chaff cutters with respect to their construction, performance parameters, material flow, and loss evaluation.                                                         |
| <b>CO4</b> | Evaluate the performance and suitability of root crop diggers, cotton and maize harvesters, and other specialized harvesting equipment based on operational efficiency and testing standards.                        |
| <b>CO5</b> | Develop and perform practical skills in calibration, operation, testing, and evaluation of plant protection, intercultural, and harvesting machinery, including computation of application rates and machine losses. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Contact Hrs. | Mapped CO |
|----------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Plant protection equipment: Different types of sprayers and dusters; Classification of sprayers and sprays; Types of nozzles; Calculations for calibration of sprayers and chemical application rates; Introduction to interculture equipment; Weeders- different types of manual and powered weeders; Functional requirements of weeders and main components; Different types of fertilizer application methods and equipment.                                                                                                                                           | 8            | CO1       |
| 2        | Unit 2            | Harvesting of crops: Harvesting methods, harvesting terminology; Mowers- types, constructional details, working and adjustments; Shear type harvesting devices- cutter bar, inertia forces, counter balancing, terminology, cutting pattern; Reapers, binders and windrowers- principle of operation and constructional details; Hay conditioning, importance, methods of hay conditioning, and calculation of moisture content of hay.                                                                                                                                   | 8            | CO 2      |
| 3        | Unit 3            | Threshing: manual and mechanical systems; Types of threshing drums and their applications; Types of threshers- tangential and axial, constructional details and cleaning systems; Factors affecting thresher performance; Grain combines- combine terminology and features, classification of grain combines, study of material flow in combines; Computation of combine losses; Combine troubles and troubleshooting; Chaff cutters- working principle, constructional features and capacity calculations; Straw combines- working principle and constructional details. | 8            | CO 3      |
| 4        | Unit 4            | Root crop diggers: Principles of operation, functional components, blade adjustment and approach angle, calculation of material handled; Potato and groundnut diggers; Cotton harvesting cotton harvesting mechanisms, cotton pickers and strippers; Maize harvesting combines; Vegetables and fruit harvesting equipment and tools. Testing and Evaluation of intercultural, plant protection and harvesting machinery and their test codes                                                                                                                              | 8            | CO 4      |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|
| Familiarization with plant protection and interculture equipment; Study of sprayer types, functional components, calibration; Study of dusters- types and functional components; Calculations for chemical application rates; Study of nozzle types and spread pattern using patternator; Familiarization with manual and powered weeding equipment and identification of functional components; Study of fertilizer application equipment including manure spreaders and fertilizer broadcasters; Study of various types of mowers, reaper, reaper binder; Study of functional components of mowers and reapers; Study of threshing systems, cleaning systems in threshers, calculations of losses in threshers; Study of functional units of grain | 30 | CO 5 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|



## Integral University, Lucknow

combines and their types, calculations for grain losses in a combine; Study of root crop diggers and familiarization with the functional units and attachments; Study of the working of cotton and maize harvesters; Study of different vegetable and fruit harvesters; Testing and evaluation of intercultural, plant protection and harvesting machinery; Visit to field showing operations various machines; Visit to implement manufacturing unit.

### Suggested Readings:

1. Jain, S. C. and Phillips, G. 2003. *Farm Machinery - An Approach*. Standard Publishers and Distributors.
2. Kepner, R. A., Bainer, R. and Barger, E. L. 2005. *Principles of Farm Machinery*. CBS Publishers and Distributors.
3. Lal Radhey and Datta, A. C. 1978. *Agricultural Engineering through Worked Out Examples*. Saroj Prakashan, Allahabad

### e-Learning Source:

<https://agrimoon.com/wp-content/uploads/Farm-Machinery-and-Equipment-II.pdf>

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                               | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 3   | 2    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3    | 2    | 3    | 1    |
| CO2                                                            | 3   | 3   | 2   | 2   | 1   | 2   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 2    |
| CO3                                                            | 2   | 3   | 1   | 3   | 2   | 3   | 3   | 3   | 2   | 3    | 2    | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 3    | 2    | 3    |
| CO4                                                            | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 1   | 2    | 3    | 3    | 1    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 2    |
| CO5                                                            | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 3   | 3   | 1    | 3    | 2    | 3    | 3    | 2    | 3    | 2    | 2    | 1    | 3    | 3    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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| Name & Sign of Program Coordinator | Sign & Seal of HoD |
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## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AE274                                                                                                                                                                                                                   | Title of the Course | Renewable Energy Sources | L | T | P | C |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------|---|---|---|---|
| Year              | II                                                                                                                                                                                                                      | Semester            | IV                       | 2 | 0 | 1 | 3 |
| Course Objectives | To make the students acquainted with the different renewable energy sources and to enable them to analyse and select the appropriate technology to meet the energy demand in different types of agricultural operations |                     |                          |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                                                                                                                           |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Recall and describe various renewable energy sources (solar, wind, biomass, geothermal, and ocean energy), their concepts, limitations, and basic principles of solar thermal energy conversion systems.                  |
| <b>CO2</b> | Explain the working principles of solar photovoltaic systems and wind energy conversion systems, and apply fundamental equations to estimate energy generation and cost economics.                                        |
| <b>CO3</b> | Analyze the processes of anaerobic digestion and biogas production, including factors affecting performance, design considerations, and utilization of biogas and slurry.                                                 |
| <b>CO4</b> | Evaluate different renewable energy technologies such as biomass energy systems, waste-to-energy systems, ocean energy, and micro-hydel plants based on efficiency, feasibility, and sustainability.                      |
| <b>CO5</b> | Develop and perform experimental analysis and performance evaluation of renewable energy systems including solar thermal devices, photovoltaic systems, biogas plants, and biomass gasifiers, along with cost estimation. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Contact Hrs. | Mapped CO |
|----------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Different sources of renewable energy: Concepts and limitations of different renewable energy sources (RES) as solar, wind, geothermal, biomass, ocean energy sources; Criteria for assessing the potential of RES; Comparison of renewable energy sources with non-renewable sources. Solar energy: Energy available from sun, solar radiation data, solar energy conversion into heat through flat plate and concentrating collectors, different solar thermal devices, principle of natural and forced convection solar drying system;                                                    | 8            | CO1       |
| 2        | Unit 2            | Solar photo voltaics- basics and applications, p-n junctions; Solar cells, PV systems, stand alone, grid connected solar power station; Calculation of energy through photovoltaic power generation and cost economics. Wind energy: Energy availability, general formula, lift and drag; Basics of wind energy conversion, effect of density, frequency variances, angle of attack, wind speed, types of windmill rotors, determination of torque coefficient, induction type generators; Working principle of wind power plant; Wind farms, aero-generators, wind power generation system. | 8            | CO 2      |
| 3        | Unit 3            | Biogas: Basics of anaerobic digestion, types and constructional details of biogas plants, biogas generation and its properties, factors affecting biogas generation and usages, design considerations, advantages and disadvantages of biogas spent slurry; Generation of power from biogas; Design and use of different commercial biogas plants.                                                                                                                                                                                                                                           | 8            | CO 3      |
| 4        | Unit 4            | Power generation from urban, municipal and industrial waste; Ocean thermal and electric power generation, wave and tidal power; Power generation from biomass (gasification and Dendrothermal); Mini and micro hydel plants; Fuel cells and its associated parameters.                                                                                                                                                                                                                                                                                                                       | 7            | CO 4      |

### Practical

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|
| Study of solar thermal devices like solar cookers; Study of solar water heating system; Study of natural convection solar dryer; Study of forced convection solar dryer; Study of solar desalination unit; Study of solar greenhouse for agriculture production; Study of cost economics of solar thermal devices including solar panels; Study of solar photovoltaic system and study of characteristics of solar photovoltaic panel; Study of evaluation of solar air heater/dryer; Study of biogas plants and its components; Performance evaluation of a fixed dome type biogas plant; Performance evaluation of floating drum type biogas plant; Study of biomass gasifiers; Study of cost economics of biogas system; Visit to a windmill plant. | 30 | CO 5 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|

### Suggested Readings:



## Integral University, Lucknow

1. Basu, P. 2018. *Biomass Gasification and Pyrolysis Practical Design and Theory*. Academic Press.
2. Deublein, D. and Steinhauser, A. 2008. *Biogas from Waste and Renewable Resources*. WILEYVCH Verlag GmbH & Co. KGaA, Weinheim.
3. Duffie, J. A. and Beckman, W. A. 2013. *Solar Engineering of Thermal Process*. John Wiley and Sons.
4. Julian Chen, C. 2011. *Physics of Solar Energy*. John Wiley & Sons, Inc.
5. Khan, B. H. 2006. *Non-Conventional Energy Resources*. The McGraw Hill Publishers.

### e-Learning Source:

<https://agrimoon.com/wp-content/uploads/Renewable-Energy-Sources.pdf>

<https://agrigyan.in/agricultural-engineering-notes-pdf/>

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO                                               | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 2   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 3   | 2    | 3    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 2    | 3    | 2    |
| CO2                                                            | 3   | 3   | 2   | 2   | 1   | 2   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 2    |
| CO3                                                            | 2   | 3   | 1   | 3   | 2   | 3   | 3   | 3   | 2   | 3    | 2    | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 3    | 2    | 3    |
| CO4                                                            | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 1   | 2    | 3    | 3    | 1    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 2    |
| CO5                                                            | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 3   | 3   | 2    | 3    | 2    | 3    | 3    | 2    | 3    | 3    | 2    | 1    | 3    | 2    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

|                                    |                    |
|------------------------------------|--------------------|
| Name & Sign of Program Coordinator | Sign & Seal of HoD |
|------------------------------------|--------------------|



## Integral University, Lucknow

| Effective from Session: 2026-2027 |                                                                                                                                                                        |                     |                                                          |   |   |   |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------|---|---|---|
| Course Code                       | AE277                                                                                                                                                                  | Title of the Course | Post-Harvest Engineering of Cereals, Pulses and Oilseeds | L | T | P |
| Year                              | II                                                                                                                                                                     | Semester            | IV                                                       | 2 | 0 | 1 |
| Course Objectives                 | To make the students acquainted with the different unit operations in processing of major cereals, pulses and oilseeds, and the different equipment for the operations |                     |                                                          |   |   |   |

| Course Outcomes<br>Students will be able to |                                                                                                                                                                                                    |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                         | Recall and describe unit operations in agricultural process engineering, structure and composition of grains, and principles of cleaning, grading, and separation techniques.                      |
| CO2                                         | Explain drying principles, moisture relationships, and psychrometric properties, and apply drying theories and equations to analyze grain drying systems and performance.                          |
| CO3                                         | Analyze grain storage systems, size reduction mechanisms, and material handling equipment with respect to design, operation, and efficiency.                                                       |
| CO4                                         | Evaluate milling processes of rice, wheat, corn, pulses, and oilseeds, including pre-conditioning, processing methods, and equipment performance for product quality and efficiency.               |
| CO5                                         | Develop and perform experimental studies on grain processing operations including cleaning, drying, size reduction, milling, and material handling, and interpret results for system optimization. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Contact Hrs. | Mapped CO |
|----------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | General unit operations in agricultural process engineering and importance of these unit operations in grain processing; Structure and composition of cereals, pulses and oil seeds. Cleaning and grading: Principles of cleaning, scalping, sorting and grading; screens, different types of screen separators, fixed and variable aperture screens, capacity and effectiveness of screens, sieve analysis; various types of separators as specific gravity, magnetic, disc, spiral, pneumatic, inclined belt draper, velvet roll separator, colour sorter, cyclone separator.                                                                                                                                     | 8            | CO1       |
| 2        | Unit 2            | Drying: Moisture content and water activity, free moisture, bound moisture 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 periods, drying equations, mass and energy balance, Shedd's equation; Drying methods (conduction, convection, radiation, batch, continuous); Different types of grain dryers (bin, flat bed, LSU, columnar, RPEC, fluidized, rotary and tray), tempering during drying; dryer performance.                                                         | 8            | CO 2      |
| 3        | Unit 3            | Principles of grain storage; different types of grain storage structures; deep bin and shallow bin; design of a silo, structural and functional requirements of a grain storage go-down. Size reduction: Principle; Bond's law, Kick's law, Rittinger's law; Sieve analysis; Different classifications of size reduction machines; description of jaw crusher, hammer mill, attrition mill, and ball mill; Material handling: Basic parts of different types of conveyors and elevators, viz. belt, roller, chain, screw, and bucket elevator, cranes and hoists, pneumatic conveying, power requirement for conveying and elevating.                                                                               | 8            | CO 3      |
| 4        | Unit 4            | Milling of rice: Parboiling- merits and demerits, changes during parboiling of rice, parboiling methods, viz. traditional methods, CFTRI method, Jadavpur method, pressure parboiling; different unit operations and equipment involved in traditional and modern rice milling methods; Preparation of rice products as rice flakes and puffed rice. Milling of wheat: Unit operations and equipment; Milling of corn: unit operations and equipment in dry and wet milling methods; Milling of pulses: pre-conditioning, dry milling and wet milling methods, CFTRI and Pantnagar methods, pulse milling machines; Milling of oilseeds: preconditioning of oilseeds, mechanical expression, screw press, hydraulic | 8            | CO 4      |



## Integral University, Lucknow

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                                                                |    |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------|----|------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  | press, solvent extraction method, refining of oil, stabilization of rice bran. |    |      |
| <b>Practical</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                                                                |    |      |
| Study of different types of screens and study of screen effectiveness; Study of construction and operation of different types of cleaners and separators; Measurement of moisture content: dry basis and wet basis; Study on drying characteristics of grains and determination of drying constant; Determination of EMC (static and dynamic method); Study of psychrometric chart; Study of various types of dryers; Study of different size reduction machines; Sieve analysis, determination of fineness modulus and uniformity index; Study of different unit operations and machineries in rice mills; Study of different unit operations and machineries in pulse mills; Study of different unit operations and machineries in oil mills; Study of different unit operations and machineries in wheat/ flour mills; Study of different unit operations and machineries in corn processing units; Study of extrusion process; Study of different types of conveying and elevating equipment. |  |                                                                                | 30 | CO 5 |
| <b>Suggested Readings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                                |    |      |
| 1. Chakraverty, A. 1999. <i>Post Harvest Technology of Cereals, Pulses and Oilseeds</i> . Oxford & IBH publishing Co. Ltd, New Delhi.<br>2. Dash, S. K., Bebartta, J. P. and Kar, A. 2012. <i>Rice Processing and Allied Operations</i> . Kalyani Publishers, New Delhi.<br>3. Geankoplis, C. J. 2002. <i>Transport Processes and Unit Operations</i> . Prentice Hall of India Pvt. Ltd, New Delhi.<br>4. Mangaraj, S., Dash, S. K., Swain, S. and Ali, N. 2016. <i>Agricultural Process Engineering</i> . Vol II. Kalyani Publishers, New Delhi.<br>5. McCabe, W. L., Smith, J. C. and Harriott, P. 1993. <i>Unit Operations of Chemical Engineering</i> . McGraw Hill                                                                                                                                                                                                                                                                                                                           |  |                                                                                |    |      |
| <b>e-Learning Source:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                |    |      |
| <a href="https://agrimoon.com/wp-content/uploads/Crop-Process-Engineering.pdf">https://agrimoon.com/wp-content/uploads/Crop-Process-Engineering.pdf</a><br><a href="https://www.bputevaluation.com/assets/subject_pdfs/RAG5C003.pdf">https://www.bputevaluation.com/assets/subject_pdfs/RAG5C003.pdf</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                                |    |      |

| Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-PSO<br>CO                                                   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1                                                            | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 3   | 2    | 3    | 3    | 3    | 3    | 3    | 2    | 3    | 3    | 2    | 3    | 1    |
| CO2                                                            | 3   | 3   | 2   | 2   | 1   | 2   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 2    |
| CO3                                                            | 2   | 3   | 1   | 3   | 2   | 3   | 3   | 3   | 2   | 3    | 2    | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 3    | 2    | 3    |
| CO4                                                            | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 1   | 2    | 3    | 3    | 1    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 2    |
| CO5                                                            | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 3   | 3   | 1    | 3    | 2    | 3    | 3    | 2    | 3    | 2    | 2    | 1    | 3    | 3    |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

|                                    |                    |
|------------------------------------|--------------------|
| Name & Sign of Program Coordinator | Sign & Seal of HoD |
|------------------------------------|--------------------|



## Integral University, Lucknow

**Effective from Session: 2026-2027**

| Course Code       | AG257                                                                                                                                                                                                                                                            | Title of the Course | Entrepreneurship Development and Business Management | L | 2 | T | 0 | P | 1 | C | 3 |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------------------------------|---|---|---|---|---|---|---|---|
| Year              | II                                                                                                                                                                                                                                                               | Semester            | IV                                                   |   |   |   |   |   |   |   |   |
| Course Objectives | 1. To provide the student an insight into the concept and scope of entrepreneurship<br>2. To expose to various aspects of establishment and management of a small business unit<br>3. To enable the student to develop financially viable agribusiness proposal. |                     |                                                      |   |   |   |   |   |   |   |   |

### Course Outcomes

Students will be able to

|            |                                                                                                                                                                                                         |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Recall and describe the concepts, evolution, characteristics, and types of entrepreneurship, along with key entrepreneurial competencies and development processes.                                     |
| <b>CO2</b> | Explain the process of environment scanning and opportunity identification, and apply knowledge of institutional support, policies, and schemes for establishing entrepreneurial ventures.              |
| <b>CO3</b> | Analyze the steps involved in setting up and managing an enterprise, including project formulation, production planning, material management, and operational decision-making.                          |
| <b>CO4</b> | Evaluate managerial functions such as financial, marketing, and human resource management, and assess strategies for crisis management and sustainable enterprise growth.                               |
| <b>CO5</b> | Develop and prepare a comprehensive project proposal for an entrepreneurial venture based on field visits, interaction with entrepreneurs, and analysis of financial and institutional support systems. |

| Unit No. | Title of the Unit | Content of Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Contact Hrs. | Mapped CO |
|----------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1        | Unit 1            | Development of entrepreneurship, motivational factors, social factors, environmental factors, characteristics of entrepreneurs, entrepreneurial attributes/competencies. Concept, need for and importance of entrepreneurial development. Evolution of entrepreneurship, objectives of entrepreneurial activities, types of entrepreneurs, functions of entrepreneurs, importance of entrepreneurial development, and process of entrepreneurship development.                                                                                                                                           | 8            | CO1       |
| 2        | Unit 2            | Environment scanning and opportunity identification need for scanning–spotting of opportunity-scanning of environment– identification of product / service – starting a project; factors influencing sensing the opportunities. Infrastructure and support systems- good policies, schemes for entrepreneurship development; role of financial institutions, and other agencies in entrepreneurship development                                                                                                                                                                                          | 8            | CO 2      |
| 3        | Unit 3            | Steps involved in functioning of an enterprise. Selection of the product / services, selection of form of ownership; registration, selection of site, capital sources, acquisition of manufacturing know how, packaging and distribution. Planning of an enterprise, project identification, selection, and formulation of project; project report preparation, Enterprise Management. Production management – product, levels of products, product mix, quality control, cost of production, production controls, Material management. Production management – raw material costing, inventory control. | 9            | CO 3      |
| 4        | Unit 4            | Personal management – manpower planning, labour turn over, wages / salaries. Financial management / accounting – funds, fixed capital and working capital, costing and pricing, long term planning and short-term planning, book keeping, journal, ledger, subsidiary books, annual financial statement, taxation. Marketing management- market, types, marketing assistance, market strategies. Crisis management- raw material, production, leadership, market, finance, natural etc.                                                                                                                  | 8            | CO 4      |

### Practical

|                                                                                                                                                                                                                                          |    |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|
| Visit to small scale industries/agro-industries, Interaction with successful entrepreneurs/ agricentrepreneurs. Visit to financial institutions and support agencies. Preparation of project proposal for funding by different agencies. | 30 | CO 5 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|



## Integral University, Lucknow

### Suggested Readings:

1. Charantimath, P.M. 2009. *Entrepreneurship Development and Small Business Enterprises*. Pearson Publications, New Delhi.
2. Desai, V. 2015. *Entrepreneurship: Development and Management*. Himalaya Publishing House.
3. Desai, V. 1997. *Small Scale Industries and Entrepreneurship*. Himalaya Publ. House
4. Grover, Indu. 2008. *Handbook on Empowerment and Entrepreneurship*. Agrotech Public Academy.
5. Gupta, C.B. 2001. *Management Theory and Practice*. Sultan Chand & Sons.

### e-Learning Source:

<https://raubikaner.org/wp-content/themes/theme2/PDF/AGEXT-311.pdf>

|                  | Course Articulation Matrix: (Mapping of COs with POs and PSOs) |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |
|------------------|----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| PO-<br>PSO<br>CO | PO1                                                            | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
| CO1              | 3                                                              | 2   | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 2    | 2    | 2    | 2    |
| CO2              | 3                                                              | 3   | 2   | 2   | 1   | 3   | 2   | 2   | 3   | 3    | 1    | 2    | 2    | 3    | 3    | 2    | 3    | 2    | 3    | 2    | 3    |
| CO3              | 3                                                              | 3   | 2   | 3   | 2   | 3   | 3   | 3   | 2   | 3    | 2    | 3    | 3    | 2    | 2    | 2    | 2    | 3    | 3    | 2    | 3    |
| CO4              | 2                                                              | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 1   | 2    | 3    | 2    | 2    | 2    | 3    | 3    | 3    | 3    | 2    | 3    | 3    |
| CO5              | 3                                                              | 3   | 2   | 3   | 3   | 2   | 2   | 2   | 3   | 2    | 3    | 2    | 3    | 3    | 2    | 3    | 2    | 2    | 2    | 3    | 3    |

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