Syllabus of Diploma in Agricultural Engineering from the academic year 2017-18

1. Department wise list of courses, course numbers and credit hours

S.No	Course No	Title of the course	Credit Hour
I. Farm Machinery and Power Engineering			
1	DE-211	Agricultural Implements	3(2+1)
2	DE-212	Agricultural Machinery	3(2+1)
3	DE-311	Operation and Maintenance of Farm Machinery	2(0+2)
4	DE-312	Tractor systems, Operation and Maintenance	3(2+1)
		Total	**11 (6+5)**
II. Irrigation and Drainage Engineering			
1	DE-121	On-Farm Irrigation and Drainage Practices	3(1+2)
2	DE-321	Micro Irrigation Principles and Practices	3(1+2)
3	DE-322	Wells and Pumps Operation and Maintenance	2(1+1)
		Total	**8(3+5)**
III. Processing and Food Engineering			
1	DE-231	Agricultural Process Engineering-I	3(1+2)
2	DE-232	Agricultural Process Engineering - II	2 (1+1)
3	DE-233	Engineering Properties and Processing of Seeds	3(1+2)
4	DE-234	Estimating and Costing of Farm Buildings and Structures	2 (1+1)
5	DE-235	Green house Technology	2 (1+1)
		Total	**12 (5+7)**
IV. Renewable Energy Engineering			
1	DE-241	Farm Power, Solar and wind energy	2(1+1)
2	DE-341	Solid waste utilization and Bio-energy	2(1+1)
		Total	**4(2+2)**
V. Soil and Water Conservation Engineering			
1	DE-251	Hydrology and Management of Watersheds	2 (1+1)
2	DE-252	Soil and Water Conservation Engineering & Practices	2(1+1)
		Total	**4 (2+2)**
VI. Basic Engineering and Applied Sciences			
A. Basic Engineering			
1	DE-161	Computer Applications -I	2(1+1)
2	DE-162	Engineering Drawing	2(0+2)

3	DE-163	Principles of fluid mechanics	2 (1+1)
4	DE-164	Principles of thermodynamics and Heat Engines	2 (1+1)
5	DE-165	Surveying and levelling – I	3(1+2)
6	DE-166	Workshop Technology – I	3 (1+2)
7	DE-167	Workshop Technology – II	3(1+2)
8	DE-261	Computer Applications -II	2(1+1)
9	DE-262	Engineering Mechanics and Material Testing	2(1+1)
10	DE-263	Principles of Electrical Engineering & Farm Electricity	2 (1+1)
11	DE-264	Soil Mechanics	2(1+1)
12	DE-265	Surveying and Levelling-II	3(1+2)
13	DE-266	Theory of Machines	2(1+1)
14	DE-267	Workshop Technology-III	3(1+2)
15	DE-361	Strength of Materials	2(1+1)
			35(14+21)
B. Applied sciences			
1	DE-101	Communication Skills	1(0+1)
2	DE-102	Engineering Chemistry	2 (1+1)
3	DE-103	Engineering Mathematics-I	3 (2+1)
4	DE-104	Engineering Mathematics-II	3 (2+1)
5	DE-105	Engineering Physics	2 (1+1)
6	DE-106	Environmental Science and Disaster Management	1(1+0)
7	DE-107	Principles and Practices of Crop Production	3(1+2)
8	DE-108	Principles and Practices of Soil Science and Management	3(2+1)
9	DE-301	Agricultural Engineering Extension Methods	1 (0+1)
10	DE-302	Principles of Agricultural Economics and Business Management	2 (1+1)
		Total	**21(11+10)**
VII. Student Ready Programmes			
1	DE-371	Participatory Technology Training Program	12(0+12)
2	DE-372	Project Work	8(0+8)
		Total	**20(0+20)**
		Grand Total	**115(43+ 72)**

2. Semester wise course numbers, courses, and credit hours

Sl. No.	Course number	Course title	Credit hours
1st Semester			
1	DE-101	Communication Skills	1(0+1)
2	DE-102	Engineering Chemistry	2(1+1)
3	DE-103	Engineering Mathematics-I	3(2+1)
4	DE-105	Engineering Physics	2(1+1)
5	DE-106	Environmental Science and Disaster Management	1(1+0)
6	DE-107	Principles and Practices of Crop Production	3(1+2)
7	DE-162	Engineering Drawing	2(0+2)
8	DE-166	Workshop Technology – I	3(1+2)
9	COCA-100	NCC/NSS	1(0+1)NC
		Total	**17(7+10)**
		2nd Semester	
1	DE-104	Engineering Mathematics-II	3(2+1)
2	DE-108	Principles and Practices of Soil Science and Management.	3(2+1)
3	DE-121	On-Farm Irrigation and Drainage Practices	3 (1+2)
4	DE-161	Computer Applications -I	2(1+1)
5	DE-163	Principles of fluid mechanics	2(1+1)
6	DE-164	Principles of thermodynamics and Heat Engines	2(1+1)
7	DE-165	Surveying and leveling – I	3(1+2)
8	DE-167	Workshop Technology – II	3(1+2)
9	COCA-200	Physical Education	1(0+1)NC
		Total	**21(10+11)**

3rd Semester			
1	DE-211	Agricultural Implements	3(2+1)
2	DE-231	Agricultural Process Engineering-I	3(1+2)
3	DE-235	Green house Technology	2 (1+1)
4	DE-252	Soil and Water Conservation Engineering & Practices	2(1+1)
5	DE-261	Computer applications- II	2(1+1)
6	DE-264	Soil Mechanics	2(1+1)
7	DE-265	Surveying and Leveling-II	3 (1+2)
8	DE-267	Workshop Technology-III	3(1+2)
		Total	**20(9+11)**
4th Semester			
1	DE-212	Agricultural Machinery	3 (2+1)
2	DE-232	Agricultural Process Engineering - II	2 (1+1)
3	DE-233	Engineering Properties and Processing of Seeds	3(1+2)
4	DE-234	Estimating and Costing of Farm Buildings and Structures	2 (1+1)
5	DE-241	Farm Power, Solar and wind energy	2 (1+1)
6	DE-251	Hydrology and Management of Watersheds	2 (1+1)
7	DE-262	Engineering Mechanics and Material Testing	2(1+1)
8	DE-263	Principles of Electrical Engineering & Farm Electricity	2 (1+1)
9	DE-266	Theory of Machines	2(1+1)
		Total	**20(10+10)**

5th Semester			
1	DE-301	Agricultural Engineering Extension Methods	1 (0+1)
2	DE-302	Principles of Agricultural Economics and Business Management	2 (1+1)
3	DE-311	Operation and Maintenance of Farm Machinery	2(0+2)
4	DE-312	Tractor systems, Operation and Maintenance	3 (2+1)
5	DE-321	Micro Irrigation Principles and Practices	3(1+2)
6	DE-322	Wells and Pumps Operation and Maintenance	2(1+1)
7	DE-341	Solid waste utilization and Bio-energy	2(1+1)
8	DE-361	Strength of Materials	2(1+1)
		Total	**17(7+10)**
6th Semester			
1	DE-371	Participatory Technology Training Program	12(0+12)
2	DE-372	Project Work	8 (0+8)
		Total	**20(0+20)**
		Grand Total	**115(43+72)**

I Year I Semester

COMMUNICATION SKILLS

DE – 101 **1 (0+1)**

Objective: To impart the knowledge to students on technical writing and communication skills and presentation skills

PRACTICALS

1. Letter writing, Personal, Official, covering letters, Preparation of bio-data – resume or curriculum –vitae and Job application letter.
2. Non-Verbal Communication
   Report: Writing a Massage, Correspondence: Language and Grammar: a) Parts of Speech, b) Tense, c) Sentence
3. Voice: a) Active voice-with examples, b) Passive Voice –with examples, c) Direct and Indirect speech examples, d) Subject – Verb Agreement.
4. Basic Sentence Structures.
5. Articles: a) Definite, b) Indefinite articles and their usage in a sentence
6. List out some important Antonyms and Synonyms
7. Terminology of Agriculture in English
8. Essay writing or creative writing
9. Dictionary: uses of dictionary and effective utilization.
10. Dialogue delivery: Conversation dialogues.
11. Prepositions – Important prepositions in daily English conversation
12. Verb and its forms or be forms and infinitive
13. The Tense – the Present Tense – the Past Tense – the Future Tense.
14. The Tense –Present Perfect Tense
15. Practical Examination

REFERENCES

1. Enhancing English and Employability Skills – 1 — English faculty of Government Polytechnics, Andhra Pradesh
   State Board of Technical Education & Training, AP, Near Tank Bund, Hyderabad-63
2. Enhancing English and Employability Skills – 2 — English faculty of Government Polytechnics, Andhra Pradesh
   State Board of Technical Education & Training, AP, Near Tank Bund, Hyderabad-63
3. Enhancing English and Employability Skills – 3 — English faculty of Government Polytechnics, Andhra Pradesh
   State Board of Technical Education & Training, AP, Near Tank Bund, Hyderabad-63
4. Enhancing English and Employability Skills – 4 — English faculty of Government Polytechnics, Andhra Pradesh
   State Board of Technical Education & Training, AP, Near Tank Bund, Hyderabad-63

ENGINEERING CHEMISTRY

DE – 102 **2(1+1)**

Objective: To study the chemical aspects of engineering materials and processes such as phase rule, ionisation, corrosion, lubricantsetc.,which will give good insight to the students to go for engineering applications in agricultural engineering industries.

THEORY

1. Fundamentals of chemistry – fundamental particles of atom – atomic number, mass number.
2. Chemical bonds – types of bonds – properties of ionic, covalent and coordinate compounds.
3. Fundamentals of organic chemistry – features of organic compounds – difference between organic and inorganic compounds
4. Sources of organic compounds – role of organic compounds in agriculture
5. Common ion effect – Applications – solubility product – Ionization – factors influencing ionization – ionic equilibrium.

6,7&8. Electrolysis – electrolytes – classification of electrolytes - mechanism of electrolysis – Ohm's law - conductance of electrolytes – measurement of electrolyte conductance – measurement of specific conductivity by wheatstone bridge

9. Water – sources – impurities – Hardness of water – types of hardness – degree of hardness – units of hardness – disadvantages of hardwater for industrial and agricultural use.
10. Water softening methods –zeolik process – ion exchange or deionization process - mixed bed deionizer.
11. Lubricants – functions – mechanisms of lubrication – classification of lubricants
12. Important properties of lubricants
13. Polymers – basic concepts of polymerization – plastics – characteristics of plastics – advantages and disadvantages of plastics.
14. Important plastics – polythene – PVC – Bakelite.

15. Fuel – definition – classification – characteristics of good fuel – petroleum – gaseous fuels.

16. Rubbers – compounding of rubber – vulcanization of rubber – silicone rubber – properties and uses.

PRACTICALS

1. Glass ware and chemicals used in laboratory
2. Care, maintenance, dos and donts in laboratory
3. Types of expressing solution concentration – equivalent weight, normality, molarity, %, ppm
4. Preparation of standard solution (normal, molar, %, ppm solutions).
5. Standardization of H_2SO_4
6. Collection of irrigation water sample
7. Determination of pH and EC of irrigation water.
8. Determination of CO_3^{2-} and HCO_3^- in irrigation water.
9. Standardization of NO_3
10. Determination of chlorides in irrigation water.
11. Determination of Na content in irrigation water.
12. Standardization of EDTA
13. Determination of total hardness (Ca+Mg) in water
14. Irrigation water quality – Rating for EC, SAR and RSC
15. Interpretation of irrigation water quality for agriculture.
16. Saponification value for fat and oils

REFERENCES:

1. Intermediate Chemistry Vol 1 & 2 — Telugu academy, Board of Intermediate Education, Andhra Pradesh, Hyderabad

2. Engineering chemistry &Environmental studies — Dr. G. Venkatanarayana, Falcon's Publications
Shop. No. 4-5-61, Beside Andhra Bank, Women College Road, Kothi, Hyderabad.

ENGINEERING MATHEMATICS-I

DE – 103 **3(2+1)**

Objective: To impart the knowledge on advanced aspects of engineering calculus to enable students to apply for solving the engineering problems in the courses of agricultural, civil and mechanical engineering**.**

Theory

1. Theory on removal of brackets, Ratio and proportion
2. Literal values, Vulgar fraction, Algebraic identities
3. Function notation, Types of functions and symmetric expressions
4. Surds and rationalizing factors
5. Logarithms
6. Quadratic equations elementary concepts
7. Matrix, types of matrices, equality of matrices
8. Transpose of a matrix. Algebra of matrices: Addition and Subtraction of Matrices
9. Algebra of matrices: Matrix Multiplication and its properties
10. Determinant of a square matrix, singular and non-singular matrices
11. Adjoint of a square matrix, inverse of a square matrix
12. Solutions of Simultaneous linear equations by Inverse matrix method and Cromer's rule method
13. Solutions of Simultaneous linear equations by Gauss-Jordan method.
14. Addition formulae for two angles, subtraction formulae for two angles, two important identities, trigonometric ratios of A+B+C
15. Multiple and sub-multiple angles
16. Transformations. Applications of Transformations
17. Inverse trigonometric functions
18. Properties of Inverse trigonometric functions
19. Trigonometric equations
20. Applications of Trigonometric equations
21. Properties of triangles
22. Solutions of triangles and complex numbers
23. Constants, variables, Intervals & Neighborhoods and Functions & Graphs of functions
24. Standard limits and Properties of limits. One side limits
25. Continuity of a function
26. Differential co-efficient of a function, fundamental theorem of differentiation
27. Elementary properties of derivatives, derivatives of a standard functions
28. Chain rule formulae and applications
29. Derivatives of inverse function
30. Logarithmic differentiation
31. Parametric differentiation, implicit differentiation
32. Differentiation of one function with respect to another function

Practical

1. Problems on Surds, rationalizing factors and Logarithms
2. Problems on Quadratic equations
3. Problems on Algebra of matrices: Addition Subtraction and Multiplications of Matrices and its properties
4. Problems on Determinant of a square matrix, singular and non-singular matrices, Adjoint of a square matrix, inverse of a square matrix
5. Problems on Solutions of Simultaneous linear equations by Inverse matrix method and Cromer's rule method
6. Problems on Solutions of Simultaneous linear equations by Gauss-Jordan method.
7. Problems on Addition formulae for two angles, subtraction formulae for two angles and Multiple and sub-multiple angles
8. Problems on Transformations
9. Problems on Inverse trigonometric functions
10. Problems on Trigonometric equations
11. Problems on Properties of triangles
12. Problems on limits and One side limits
13. Problems on Continuity of a function
14. Simple Problems on Differential co-efficients and derivatives of a standard functions and Derivatives of inverse functions
15. Problems on Logarithmic differentiation and Parametric differentiation, implicit differentiation
16. Practical Examination

References:

1) Engineering Mathematics – I : M. Vishnu Murthy, Folcon Publications
2) Engineering Mathematics – I :Dr. K. V. Ramana, K. Kusuma, Folcon Publications
3) Engineering Mathematics – I :G. Sri Nagesh, A. Anjaiah, A. Seshapani, Folcon Publications
4) Advanced Engineering Mathematics (Updated version)-R.K .Jain & S.R.K Iyenger
5) Differential Calculus by Shanti Narayan, 2015. S. Chand and Co. Ltd. New Delhi.
6) Shanti Narayan 2004. A Text Book of Matrices. S.Chand and Co. Ltd., New Delhi.

ENGINEERING PHYSICS

DE – 105 **2 (1+1)**

Objective: To give insight to students about elements, kinematics and optics required for engineering studies related to instrumentation, operation of equipment and controls

THEORY

1. **Units and Dimensions**

   Introduction – Physical quantity – fundamental and derived physical quantities-unit. Fundamental and derived units – SI units with symbols-Rules of writing SI units-Advantages-Dimensions and Dimension formula-principle of Homogeneity of Dimensions.

2. **Elements of Vectors:**

   Introduction - Scalar-Vector-Definitions-Examples-Graphical representation of Vectors-types of vectors-Addition and subtraction of vectors-representation of vector in space Resolution of vectors - Resultant of the vectors by component method. (Parallelogram Law of vectors-Triangle Law of vectors to be covered in practical class). Dot product of two vectors - properties – Cross product of two vectors – properties.

3&4. **Kinematics:**

   Equations of motion in straight line – Acceleration due to gravity- expression for max. height –time of ascent-time of descent and velocity on reaching the point of projection. Derivation for height of a tower when a body is projected upwardly from the top-projectile motion-Horizontal projection –Derivation for the path of horizontal projection-Derivation for maximum height. Time of flight and horizontal range maximum range of a projectile in oblique projection. Derivation for magnitude and direction of resultant velocity in oblique projection.

5. **Friction**

   Introduction**:** Definition- Types of friction-laws of friction (static and kinetic) coefficient of friction –Angle of friction with respect to rough horizontal surface-Derivations for displacement and time taken to come to rest over a rough horizontal surface-work done by frictional force-Advantage and disadvantages of friction-methods of minimizing friction.

6. **Work-Power-Energy**

   Definitions of work-Power-Energy-concept of power - Definition of potential energy. Expression for potential energy - Definition of kinetic energy-expression for kinetic energy – workenergy theorem –law of conservation of energy and its verification in the case of falling body and simple pendulum. Conventional and non-conventional energy sources.

7. **Simple Harmonic Motion:**

   Definition-conditions of SHM-Equation for SHM as projection of particle executing uniform circular motion. Expression for displacement-velocity and acceleration.

8&9. **Heat and thermodynamics:**

   Introduction -Expansion of gases-Boyle's Law (its verification practical class)

Charles Law-Absolute scale of temperature - Ideal gas equation-gas constant – universal gas constant - gas equation in terms of density. Difference between r and R-concept of internal energy- External work done by a gas. Isothermal process and Adiabatic process-law of thermodynamics-specific heats of gas - Relation Cp-Cv=R.

10. **Sound**

Introduction – Musical sound and noise and difference between them – noise pollution-causes for noise pollution - effects of noise pollution - methods to minimize noise pollution - beats - application – Doppler effect- formula for apparent frequency (a) source in motion-observer at rest (b) observer in motion – source at rest- Applications reverberation- reverberation time echoes

11. **Properties of Matter**

Introduction to Elasticity – Definitions of stress-Strain - Hooke's Law- types of stress –types of strain - Types of moduli of elasticity.

i) Definition of surface tension – Explanation of surface tension with the help of molecular theory-definition of angle of contact and capillarity-formula for surface tension – Determination of surface tension by capillary rise method.
ii) Definition of viscosity - coefficient of viscosity-Newton's formula for viscous force. Effect of temperature on viscosity. Poiseuille's equation and determination of coefficient of viscosity by Poiseuille's method.

12&13 **Electricity and Magnetism**

Introduction to electricity- Ohm's Law and explanation - specific resistance-conductance- Kirchhoff's Laws and explanation-Wheatstone's bridge. i) Meter bridge and its use to determine specific resistance - Introduction to magnetism (To be covered in practical class) coulomb's inverse square law
Magnetic field and magnetic lines of force
Magnetic induction field strength – units
Moment of couple on bar magnet placed in a uniform magnetic field-Derivation for magnetic induction field strength at a point on the axial line.

14,15& 16. **Modern physics**

Photo-electric effect-Einstein's photo electric equation - Laws of photoelectric effect working of photoelectric cell - photomultiplier – Applications of photoelectric effect. Recapitulation of refraction of light and its law's - critical angle- total internal reflection. Principle and working of optical fiber- Types of optical fibers-Applications of optical fibers - super conductor-super conductivity – properties of super conductors – Applications of super conductors.

PRACTICALS

1. Determination of volume of a cylindrical body with vernier caliper
2. Determination of thickness of the given body with screw gauge
3. Determination of the weight of given body corrected up to milligram using physical balance.
4. To determine thickness and radius of curvature of convex or concave lense with spherometer.
5. To verify parallelogram law of forces and triangular law of forces.
6. To verify the laws of simple pendulum and to determine the acceleration due to gravity.
7. To determine the velocity of sound in air using resonance apparatus at room temperature.
8. To find the focal length and power of convex lense by U-V method.
9. To determine the refractive index of a given solid using Travelling microscope.
10. To find out the surface tension of water by capillary rise method
11. To determine the coefficient of viscosity of a liquid by poiseullies method.
12. To verify Boyle's law in air using Boyle's apparatus
13. To determine resistance and specific resistance of the material (wire) using meter bridge.
14 & 15 To map magnetic lines of force around a bar magnet.
16. Practical Examination

REFERENCES

1. Engineering Physics — M. Raghavendra
   Falcon's Publications
   Shop. No. 4-5-61, Beside Andhra Bank, Women College Road, Kothi, Hyderabad.
2. Engineering Physics — S. B. Singh
   Falcon's Publications
   Shop. No. 4-5-61, Beside Andhra Bank, Women College Road, Kothi, Hyderabad.

ENVIRONMENTAL SCIENCE AND DISASTER MANAGEMENT

DE – 106 **1 (1+0)**

Objective: To enable the students to understand the farming principles to grow agricultural field and horticultural crops and all farming practices.

THEORY

1. Definition – scope and importance of environmental studies – need for public awareness, people and institutions in environment.
2. Natural resources – renewable and non-renewable resources -forest resources –functions of forests – causes and consequences of deforestation.
3. Water resources - Use and over-utilization of surface and ground water, floods, cyclones, drought, conflicts over water, dams-benefits and problems.
4. Food resources – Food sources, World food problems and security.
5. Energy resources: renewable and non-renewable energy sources.
6. Land resources - Land as a resource, land degradation, man induced landslides, earthquakes, tsunami, soil erosion and desertification. Role of an individual in conservation of natural resources.
7. Biodiversity – definition – types of biodiversity – bio-geographical classification in India – methods of measuring biodiversity – Biodiversity Act – functions of National Biodiversity Board.
8. Threats to biodiversity – habitat loss – poaching of wild life – man-wild life conflicts– conservation of biodiversity – in situ and ex situ.
9. Environmental pollution – causes, effects and control measures of air and water pollution – tolerable limits for toxic gases in air.
10. Causes, effects and control measures of soil pollution – bioremediation – tolerable limits for heavy metals in soil.
11. Causes, effects and control measures of thermal, marine and noise pollution.
12. Causes, effects and management of nuclear hazards, hazardous wastes, agricultural wastes and industrial wastes.
13. Solid Waste Management: causes, effects and control measures of urban and industrial wastes.
14. Social Issues and the Environment from Unsustainable to Sustainable development. The Environment Protection Act – The Air (prevention and control of pollution) Act.
15. The Water (prevention and control of pollution) Act – The Wildlife Protection Act and Forest Conservation Act.
16. Woman and child welfare – Human Immune-deficiency Virus (HIV) / Acquired Immunodeficiency Syndrome (AIDS) – role of information technology on environment and human health

REFERENCES

1. Bharucha, E. 2005. *Textbook of Environmental Studies for Under Graduate Courses*. University Grants Commission, University Press. Hyderabad
2. Gupta, P.K. 2004. *Methods in Environmental Analysis – Water, Soil and Air*. Agrobios (India), Jodhpur.
3. Manohara chari, C. and Jaya Ram Reddy 2004. *Principles of Environmental Studies*. B SPublication, Hyderabad.

PRINCIPLES AND PRACTICES OF CROP PRODUCTION

DE – 107 **3(1+2)**

Objective: To enable the students to understand the farming principles to grow agricultural field and horticultural crops and all farming practices.

THEORY

1. Development of Agriculture in India.
2. Agro climatic zones of Andhra Pradesh.
3. Monsoons – seasons-seasonal crops. Classification of crop.
4. Tillage-tilth-objectives of tillage – types of tillage (Primary, secondary and – seed bed preparation – puddling).
5. Seeds-seed material – characteristics of seed/seed material. Sowing – methods of sowing, time of sowing – depth of sowing –seed rates of important crops.
6. Crop stand establishment – factors affecting crop stand establishment – plant population.
7. Soil fertility – soil productivity – soil fertility losses – maintenance of soil fertility – soil organic matter.
8. Mineral Nutrition – Essential Elements-Deficiency Symptoms – Toxicity Symptoms.
9. Manures – Bulky Organic Manures – Concentrated Organic manures – soil amendments.
10. Fertilizers – Classification – Nitrogenous, Phosphatic and Potassic Fertilizers-Fertilizer dose – Method of Fertilizer Application – Time of Fertilizer Application – Biofertilizers.
11. Irrigation water management.
12. Weed Management.
13. Dryland Agriculture.
14. Cropping systems – Crop Rotation.
15. Harvesting – Storage and Post–harvest Processing (Rice, Groundnut and Sugarcane).
16. Sustainable Agriculture and organic farming.

PRACTICALS

1. Visit to Agricultural Information Centre.
2. Identification of crops, seeds, manures, oil seed cakes and fertilizers.
3. Study of tillage implements.
4. Practice of Primary tillage.
5. Practice of Secondary tillage.
6. Practice of seed bed preparation.

7. Preparation of Rice Nurseries/Vegetable Nurseries.
8. Selection of seed, Seed treatment and germination test.
9. Study of methods of sowing.
10. Practice of sowing of ID crops.
11. Nursery pulling in rice (or any operation related to rice).
12. Transplanting of rice (or any operation related to rice).
13. Thinning and gap filling.
14. Study of Intercultivation implements.
15. Practice of intercultivation.
16. Identification of weeds.
17. Study of different weed control methods.
18. Practice of hand weeding.
19. Practice of spraying of herbicides.
20. Use of bio control agents and IWM.
21. Identification of plant diseases.
22. Spraying of fungicides.
23. Study of different irrigation methods.
24. Study of sprinkler and drip irrigation methods.
25. Identification of beneficial and harmful insects and IPM.
26. Study of maturity symptoms in crops.
27. Harvesting of crops.
28. Threshing and Winnowing.
29. Visit to Biological Control Lab (ARI).
30. Visit to Farm Implements and Machinery Scheme (ARI).
31. Visit to Rice Section and STCR scheme (ARI).
32. Visit to National Seed Project.

REFERENCES

1. Principles of Agronomy — T. Yellamanda Reddy and G.H. SankaraReddi, Kalyani Publishers, Ludhiana
2. Fundamentals of Agriculture — ArunKatyayam Kushal Publications, Varanasi

ENGINEERING DRAWING

DE – 162 **2 (0+2)**

Objective: To import the knowledge and skills on visualization of objects, equipments, machines through drawings, plans, sectional and isometric views and orthographic projections.

PRACTICALS

1. Understanding the importance of Engineering Drawing in Diploma course
2. Use of Engineering Drawing Instruments
3. Write Free Hand Lettering and Numbers as per B.S.I
4. Understand Dimensioning– Practice
5 Dimension a given drawing using standard notations and desired system of dimensioning.
6 Dimension standard features and applying necessary rules.
7. Identify the departures if any made in the given dimensioned drawing with reference to SP-46-1988.
8 Divide a given line into desired number of equal parts internally.
9 Draw tangent lines and arcs
10 Construct a Hexagon from the given data.
11 Construct ellipse by concentric circles method and using a paper trammel.
12 Construct parabola, rectangular hyperbola involute, cycloid and helix from the given data.
13 Projection of a point with respect to reference planes (HP & VP)
14 Projections of straight lines with respect to two reference planes.
15 Projections of perpendicular planes.
16 Principles of Orthographic projection with simple sketches
17 Orthographic view of an object, given its pictorial drawing
18 Minimum number of views needed to represent a given object fully.
19 The section plane for a given component to reveal maximum information and sectional view.
20 Appling conventional practices and identify the parts, which should not be shown in section while drawing sectional views.
21 Applying principles of hatching.

22 Drawing simple sections (full, half, revolved and removed part) for a range of simple Engineering objects.

23 The auxiliary views of a given Engineering component to indicate the true shape and size of component

24 Drawing the auxiliary views of a given engineering drawing

25 Objects, draw their orthographic views

26 Isometric projections for the given orthographic drawings.

27 Oblique drawing cavalier, cabinet of simple Engineering objects from the given data.

28 The correct pictorial views from a set of Orthographic drawings.

29 The need for preparing developing drawing

30 Development of simple Engineering objects using parallel line and radial line method.

31 Development of Surface of Engineering components like trays, funnel, 90^0 elbow & rectangular duct.

32 Practical examination

REFERENCES

1. Engineering Drawing — S.R. Manchu, Falcon's Publications, Shop. No. 4-5-61, Beside Andhra Bank, Women College Road, Kothi, Hyderabad.

2. Engineering Drawing — M. Subbarayudu, Falcon's Publications, Shop. No. 4-5-61, Beside Andhra Bank, Women College Road, Kothi, Hyderabad.

WORKSHOP TECHNOLOGY – I

DE – 166 **3(1+2)**

Objective: To impart knowledge and skills to students in manufacturing processes of machines, tools and equipment and hands-on training on various aspects of machine shop for encouraging entrepreneur development for engineering enterprises in general and farm mechanization in particular

THEORY

1. Introduction to workshop technology - Manufacturing process – Classification of Manufacturing process –Basic workshop process – Carpentry, Bench work and fitting – Smithy and forging – sheet metal – mechanical working of metals.
2. Carpentry – tools, marking and measuring tools - cutting tools.
3. Planning tools – Jack plain- types, Boring tools- types-striking tools, holding tool.
4. Carpentry process- Marking – sawing -planning-chiseling- Boring –Grooving – Rebating – Moulding carpentry joints
5. Wood working machines – types- components of different machines – and working principle -sanding machine, Carpentry and pattern layout - safety precautions
6. Fitting – Introduction- tools-holding tools-striking tools.
7. Cutting tools-chisel-parts-files-parts-classification, scrapers – types, Hacksaw-parts-power hacksaw.

8&9 Drill bits – types of drills; Reamer –application – types; Taps – types – application, Dies and die stocks – types – marking tools commonly used in fitting shop.

10. Gauges – types – caliper – types – micrometer types – application – miscellaneous tools - safety precautious
11. Fitting operations
12. Sheet metal work – introduction – metals used – Measuring tools – dividers-punches – chisels – hammers – snips or shears - types
13. Stakes – types – pliers – groovers- Rivet set – soldering iron

14& 15. Sheet metal operations – shearing – Bending , Drawing-Squeezing –Sheet metal joints – types- seam joints

16 Fastening Methods –Laying out a pattern, safety precautions in sheet metal work.

PRACTICALS

1. Practice on planning, sawing and chiseling
2. Prepare a Half Lap joint
3. Prepare a Dovetail joint
4. Prepare a Mortise joint
5. Prepare a drill joint

6&7. Prepare a 20cm x 15cm Teakwood Switch board with hinges and bottom hook

8. Fix the laminate sheet to the above box and cut suitable holes to mount one flush type switch, socket.

9&10. Jobs on sawing, filing and right angle fitting of MS Flat

11&12. Jobs on sawing, filing and right angle fitting of MS Flat

13&14. Practical in more complex fitting job

15&16. Jobs on Drawing, Punching, Bending, Shaping etc.

17. Cut a metal conduit, G.I. pipe and solid using hack saw
18. Thread cutting G.I. pipe, metal conduit and solid rod using Die set
19. Internal thread cutting using Tap set reamers
20. Thread Cleaning

21&22. Make a hexagonal nut from a round rod

23&24. Prepare a job and make a spot weld

25. Prepare a job and make a seam weld

26&27. Prepare a job and make a butt weld

28. Prepare a job and make a lap joint and finish it using grinder
29. Prepare the job and make T joint

30&31. Jobs on ARC welding Oxyacetylene gas welding

32. Practical exam

REFERENCE

1. Elements of workshop technology, (Volume I & II) — HajraChoudhury,S.K.,HajraChoudhury, A.K. and Nirjhar Roy, 2010. MediaPromoters and Publishers Pvt. Ltd. Mumbai
2. Workshop technology (Part I & II) — Chapman, W.A.J. 1989. Arnold Publishers (India) Pvt. Ltd. AB/Safdarjung Enclave, New Delhi.
3. A course in workshop technology (Volume I & II) — Raghuwansi, B.S. 2003. DhanpatRai and Co. (P) Ltd. Educational and technical publishers. 1710, NaiSarak, New Delhi – 110006
4. Manufacturing technology- I — Pakirappa and Kumar V.N. 2010. Radiant Publishing House, Hyderabad.
5. Workshop technology — M. Anitha. Falcon Publishers, Hyderabad

I Year II Semester

ENGINEERING MATHEMATICS - II

DE- 104 **3 (2+1)**

Theory

1 Distance between two points, section formula (internal and external division) – Problems on it
2 Straight lines: Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line
3 Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines
4 Angles between two straight lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral
5 Introduction to – Circle, Equation of circle with centre and radius, General equation of a circle, Equation of circle passing through three given points and tangent of the circle
6 Introduction of matrices. Normal form of the matrix.
7 Reduction to Normal form - Working rule to find rank of matrices by reducing in to Normal form, related lower and higher order matrices to find rank by reducing to Normal form.
8 Reduction to PAQ form - Working rule of a square matrix reduction into PAQ form - related problems.
9 Finding inverse of a matrix using the row and column operations - Working rule - related problems.
10 Solution of linear equations - Consistency and Inconsistency of system of linear equations. Related problems on finding the number of solutions for system of equations.
11 Eigen values and Eigen vectors of a square matrix and problems on it
12 Introduction, properties on Eigen values and Eigen vectors – Related problems
13 Cayley-Hamilton theorem to find positive and negative powers of A
14 Definition –Finding the inverse, positive and negative powers of matrices by Cayley - Hamilton Theorem.
15 Diagonalization of matrices by Linear transformation
16 Differential calculus - Fundamentals of differentiation. Higher order derivatives.
17 Taylor's and Maclaurin's expansions - Explanation of Taylor's and Maclaurin's series of a function.
18 Taylor's and Maclaurin's expansions of Algebraic, Trigonometric and Lagorithamic function's.
19 Integral Calculus : Integration of simple functions
20 Integration of sum and difference of functions
21 Integration of Product of functions
22 Integration of functions of the type $\int e^x \sin axdx$, $\int e^x \cos axdx$, $\int \sqrt{a^2 - x^2}dx$ etc…
23 Integration by substitution method
24 Integration of the functions by trigonometric substitutions.
25 Definite Integral, Area under simple well-known curves
26 Simple problems based on Definite Integral, Area under simple well-known curves
27 Complex Numbers and its properties
28 Complex Analysis - Functions of a Complex variable- Introduction - Problems on basic

Complex functions.

29 Limits Continuity of Complex Functions- Introduction - Problems on limit

30 Continuity of complex functions. Problems on continuity

31 Analytic functions and problems- Problems on derivability of complex functions and Analytic functions.

32 Cauchy-Riemann equations, Harmonic functions- Introduction- Problems on satisfying C-R equations.

Practical

1. Problems on Locus, transformation of axes, Different forms of straight line, Equations of Normal form and Intercept form
2. Problems on Equation of circle with centre and radius, General equation of a circle, Equation of circle passing through three given points and tangent of the circle
3. Problems on Standard form of Parabola, Axis, Vertex, Focus, Directrix and Length of Latus-Rectum.
4. Problems on Ellipse and Hyperbola: Standard form of Hyperbola, Vertex, Focus, Directrix and Length of Latus-Rectum
5. Problems partial differentiation, second order partial derivatives, Homogeneous functions, Euler's theorem on homogeneous functions.
6. Problems on Geometrical and Physical applications of differentiation
7. Problems on Maxima and minima
8. Problems on Integration of simple functions
9. Problems on Integration of Product of two functions (Integration by parts)
10. Problems on Integration by substitution method and trigonometric substitution method
11. Simple problems based on Definite Integral, Area under simple well-known curves
12. Problems on Permutations and combinations
13. Problems on Binomial Theorem
14. Partial fractions, methods to resolve a rational fraction in to partial fraction
15. Problems on Probability
16. Practical Examination

References:

1) Engineering Mathematics – I : M. Vishnu Murthy, Folcon Publications
2) Integral Calculus by Shanti Narayan, 2015. S. Chand and Co. Ltd., New Delhi.
3) Differential Calculus by Shanti Narayan, 2015. S. Chand and Co. Ltd. New Delhi.
4) Grewal B S. 2004. Higher Engineering Mathematics. Khanna Publishers Delhi.
5) Ramana B. V. Engineering Mathematics. 2008. Tata McGraw-Hill. New Delhi.
6) Advanced Engineering Mathematics (Updated version)-R.K .Jain & S.R.K Iyenger.
7) Hari Arora. Differential Equations and Complex Analysis. Katson publications, New Delhi.

PRINCIPLES AND PRACTICES OF SOIL SCIENCE AND MANAGEMENT

DE -108 **3 (2+1)**

Objective: Students will be trained on concepts and analysis of soil properties, stress conditions of loaded soil , consolidation and soil failure theories .The knowledge imparted will be used in higher level design considerations for constructions of soil and water conservation structures , irrigation and drainage structures

THEORY

1 Introduction – Evolution and orgin of earth – Spheres of earth – their characteristics

2 Soil components – Mineral matter, organic matter, water and air – Pedological and edaphalogical concepts of soils – Branches of soil science

3 Rocks – Igneous rocks – Their classification based on mode of orgin and silica content – Sedimentary rocks – Formation of sedimentary rocks – Metamorphic rocks – Agents causing metamorphosis.

4-5 Minerals – Classification based on origin, Quantity, specific gravity and chemical composition-Primary minerals – Quartz, feldspars, micas, amphiboles-pyroxenes – Weatherability of primary minerals

6 -7 Weathering – Types of weathering – Physical, chemical and biological weathering – Agents and processes of weathering – Role of flora and fauna in weathering

8 Parent materials – Classification based on their mode of transport and deposition

9 Soil formation – Soil forming factors – Active and passive factors - their role in soil formation.

10 Soil forming or pedogenic processes – Basic or fundamental processes – Eluviation, Illuviation, Humification.

11 Specific pedogenic processes – Calcification, Podzolization, laterization, salinization, alkalization, Pedoturbation

12 Definition of soil – Soil profile – Description of a therotical soil profile – Master horizons and subordinate horizons – Differences between surface soil and subsurface soil

13 Soil as three phase system – Mechanical Analysis – Classification of soil solids – Size – Shape – Density – Specific surface – Chemical nature - Texture – Classification of texture – Importance of Texture.

14 Soil structure – Definition – Classification based on type – Class and grades – Factors influencing formation of aggregates – Importance and management of soil structure.

15 Soil consistency – Defintion – Forms of consistency – Atterberg's limits of soil consistency – Importance of soil consistency

16 Bulk density – Particle density – Factors influencing and importance – Porosity – Types – Calculation – Importance

17 Soil water – Structure of water molecule and the effect of H-bonding on properties of water – Retention of water in soils- soil moisture tension – Soil moisture potential – Soil moisture constants and determination of soil moisture content.

18 Soil water movement – Saturated, Unsaturated and vapour flows – Darcy's law and

Poiseuille's law – Infiltration – Factors affecting Infiltration – Importance – Percolation and permeability – Distribution of water in soil profile – Drainage and its importance – Soil mulch organic mulch

19 Soil Air- Composition of soil air – Gaseous exchange – Soil aeration indices and their importance – Oxygen content – ODR - Aeration porosity – Redox potential – Management of soil air

20 Soil temperature – Influence of soil temperature on plant growth – Factors influencing soil temperature, management of soil temperature.

21 Soil color – Its determination – Munsell description – importance of soil color

22-23 Soil colloids – General properties of soil colloids – Shape, surface area, electrical charge, adsorption, flocculation, deflocculation, plasticity, cohesion, swelling, shrinkage, tyndal effect, Brownian movement.

24-25 Ion exchange in soils – Cation exchange and anion exchange – Cation exchange capacity, Base saturation – Calculations of CEC and Base saturation.

26 Soil biology – Types of organisms in soil and their important characters – Benefits of soil organisms – Harmful activities of soil organisms

27 Soil organic matter – Decomposition of organic matter – Mineralization and immobilization – Humus

28 Importance of soil organic matter – C:N ratio – Significance of C:N ratio

29-30 Problem soils and their management - acid soils, saline soils and sodic soils – Causes for formation and reclamation

31-32 Physical problems of soils – Their management

PRACTICALS

1. Collection and processing of soil sample
2 Determination of soil pH and EC.
3 Determination of organic carbon content of soil
4 Determination of gypsum requirement of sodic soils
5 Determination of lime requirement of acid soils
6 Management of problem soils
7-8 Determination of mechanical composition of soil
9 Determination of bulk density of soil
10 Determination of particle density of soil
11 Determination of maximum water holding capacity of soil using keen cups
12 Determination of moisture content by gravimetric method
13 Determination of soil colour using Munsellcolour chart
14 Determination of infiltration rate
15 Determination of soil strength using cone penetrometer
16 Aggregate analysis by wet sieving method

REFERENCES

S. No.	Author & Title	Publisher
1.	Biswas, T.D. and Mukherjee, S.K. (1987) Text book of Soil Science	Tata McGraw-Hill Publisher Co. Ltd, New Delhi
2.	Dilip Kumar Das (2004) Introductory Soil Science	Kalyani Publishers, New Delhi
3.	Ghildyal, B.P. and Tripathi, R.P. (1987) Soil Physics	Wiley Eastern Ltd. New Delhi
4.	Dhyan Singh, Chonkar, P.K. and Pandey, R.N. (2010). Soil Testing Manual	IARI, New Delhi
5.	Singh, R.A. (1990) Soil Physical Analysis	Kalyani Publishers, Ludhiana

ON-FARM IRRIGATION AND DRAINAGE PRACTICES

DE- 121 **3(1+2)**

Objective: To impart the knowledge and skills on various concepts like duty, delta, soil-plant-water relationship, irrigation scheduling and to enable the students to design and execute proper surface and sub-surface drainage systens in salt affected and water logged areas in agricultural lands and to improve land productivity by controlling the twin problems of water logging and salinity and therby to enhance the crop production and productivity

Theory

1 Irrigation - Introduction, Necessity and Development of irrigation in India.
2 Sources of irrigation water - Surface water sources, Ground water sources - Present status of development and utilization of different water sources of the country.
3 Irrigation applications - Surface irrigation methods, border, check basin
4 Furrow irrigation and sub surface irrigation
5 Sprinkler irrigation - advantages, limitations, types, components and functions
6 Sprinkler irrigation- Installation, operation and maintenance
7 Drip irrigation- advantages, limitations, types, components and functions
8 Drip irrigation- Installation, operation and maintenance
9. Drainage - Introduction, drainage problem of the state and country, causes and effect of water logging, prevention and control of water logging.
10 Objectives of drainage- Need, purpose and benefits, Drainage requirements of various crops.
11 Interrelationship of irrigation and drainage
12 Types of drainage systems, Surface drainage, sub surface drainage, vertical drainage
13 Surface drainage – Factors and drainage coefficient, different types and design considerations
14 Design of surface drainage system and components
15 Sub surface drainage system – different types and design considerations
16 Design of sub surface drainage system and components

Practical

1. Design of irrigation open channel
2. Design of underground pipe line system
3. Study of border and check basin irrigation systems
4. Study of furrow irrigation system
5. Demonstration of volumetric method and float method of water measurement
6. Study of determination of evapotranspiration by water balance method and lysimetry method

7. Study of determination of evapotranspiration by empirical methods : thornthwaite, Penman, Blaney-criddle formula
8. Study of crop requirements
9. Determination of evapotranspiration by empirical methods : radiation and pan evaporation method
10. Design of sprinkler irrigation system, selection and spacing of sprinklers
11. Study the different components of sprinkler irrigation system
12. Study of demonstration of uniform coefficient of sprinkler irrigation system
13. Selection of pumps, power units and cost estimation of sprinkler irrigation system
14. Study of installation of sprinkler irrigation system
15. Cost estimation of sprinkler irrigation system
16. Design of drip irrigation system
17. Study the different components of drip irrigation system
18. Cost estimation of drip irrigation system
19. Study of operation and trouble shooting of sprinkler irrigation
20. Study of operation and trouble shooting of drip irrigation
21. Study of installation of drip irrigation system
22. Study of surface drainage system for flat areas
23. Study of surface drainage system for slopping areas
24. Problems on design of surface drainage system
25. Study of Hooghoudts equation for spacing of drains
26. Problems on design of sub surface drainage system
27. Study the irrigation project management
28. Visit to surface and subsurface irrigation systems
29. Visit to drainage project
30. Visit to drip and sprinkler irrigation systems
31. Conducting of mock tests
32. Practical examination.

References

1.	Irrigation - Theory and Practice	A. M. Michael, 2008, Vikas publishing Private limited, New Delhi.
2.	Agriculture drainage - Principles and Practices	U. S. Kadam, R. T. Thokal, Sunil Gorantiwar and A. G. Power, 2008,Westville Publishing House, New Delhi
3.	Irrigation and drainage	D. Lenka, 2005, Kalyani Publishers, Ludhiana,
4.	Land and Water Management engineering	V.V.N. Murthy and Madan. K. Jha, Kalyani Publishers, Ludhiana

COMPUTER APPLICATIONS-I

DE- 161 **2(1+1)**

Objective: To enable the students to understand the web based technologies and how to build applications using different ICT tools to create web sites and pages for the farming sector and Agriculture. Content can be developed to showcase farm technologies and value added farm produce to communicate with global world for making the Agriculture remunerative and attractive.

THEORY

1. Introduction to Computer Uses, Advantages and disadvantages
2. Study of a computer system component and their uses. Measurement of Memory
3. Introduction to Windows Operating System and utilities of Desktop, Task Bar , Right Click Utilities on Desktop. Opening programs, Searching of files, Copy, Paste, Move.
4. Working with Word-processing, Menus & Commands, Shortcut Menus, Toolbars, Templates, Creating a New Document , Document Views and layouts
5. Working with –Styles , Headers & Footers, Text, Paragraph, Page Formatting , Text Attributes, Text Editing, Text Enhancements
6. Bullets & Numbering: Bulleted, Numbered & Multilevel List, Format Painter and its use
7. Tabs & Indents, Auto formatting, Auto text, Autocorrect, Auto complete, Insert page numbers, symbols, images, files etc.
8. Insert Table of Contents, Footnote, Endnote, Citation, Cross Reference etc., Find & Replace, Spell Check & Grammar, Thesaurus
9. Add, Delete, Insert, Merge Rows and Columns , Convert Text to Table and Table to Text , Borders and Shading, Margins & Space management in Document
10. Adding References and Graphics , Mail Merge , Letters, Envelopes, Mailing Labels Import and Export to/from other file formats ,Printing & various print options
11. Introduction & use, working with PowerPoint, Creating a presentation Using Wizards
12. Slides & different types, Inserting, Deleting and Copying of Slides, Working with Notes, Handouts, Columns & Lists, Adding Graphics, Sounds and Movies to a Slide
13. Working with PowerPoint Objects, Designing & Presentation of a Slide Show
14. Printing Presentations, Notes, Handouts with print options , Master Slide and other Masters
15. Slide Transition, Automating Presentation, applying effects, Back up of Data to CD / DVD using a Writer Software
16. Internet – World Wide Web, Opening of a Home Page, Search Engines, Creation of user accounts, E-mail ID and using of emails with attachments, downloading

PRACTICALS

1. Introduction to Computer Uses
2. Study of computer system component
3. Introduction to Computer Operating systems
4. Working with Word-processing title bars
5. Working with word processing menu bars
6. Bullets & Numbering: Bulleted, Numbered & Multilevel List, Format Painter and its use
7. Word formatting, auto formatting, auto correct and etc.
8. Insert Table, its properties and etc.
9. Table margins, spacing management, delete, add rows and columns
10. Adding References and Graphics , Mail Merge
11. Introduction & use, working with PowerPoint
12. Slides & different types, Inserting, Deleting and Copying of Slides, Working with Notes, Handouts, Columns & Lists, Adding Graphics, Sounds and Movies to a Slide
13. Working with PowerPoint Objects, Designing & Presentation of a Slide Show
14. Printing Presentations, Notes, Handouts with print options , Master Slide and other Masters
15. Internet opening, web browsing and creation of mails.
16. Practical Exam.

REFERENCES

1. Microsoft Office 2013 Bible, Microsoft Press
2. MS OFFICE XP COMPLETE BPB publication
3. The 2007 Microsoft Office System Inside Out, Microsoft Press
4. Mastering Word 97, Mansfield, Sybex Pub.
5. Mastering Microsoft Office 97 – L.Moseley, D.Boody – BPB
6. Mastering Powerpoint 2000 – Murray K., BPB
7. The ABSs of Microsoft Office - Professional Edition by GuyHart – Davis, BPB Publication
8. MS Office Excel Step by Step, Curtis Frye, Microsoft Press

PRINCIPLES OF FLUID MECHANICS

DE-163 **2 (1+1)**

Objective: To enable the students to design efficient water conveyance systems like canals, Channels and pipes from places of origin to delivery points by acquiring Knowledge on the principles of mechanics of fluids, water measurement and Regulation and open channel hydraulic principles

THEORY

1. Fluid –definitions – classification – properties, dimensions
2. Fluid pressure-Introduction-Measurement of fluid pressure-piezometer tube - manometry-types of manometers
3. Mechanical gauges-Bourdon's Tube - Pressure guage - Diaphragm pressure guage - Dead weight pressure guage
4. Kinematics of fluid flow-introduction-continuity of fluid flow – Types of flow lines.
5. Dynamics of fluid flow-Various forms of energy in fluid flow, frictional loss, general equation
6. Bemoulli's theorem, Euler's equation of motion
7. Practical applications of Bermoulli's theorem, Venturimeter, Pitot tube, Orifice meter
8. Flow through orifices (Measurement of Discharge) – Types of orifices, Jet of water, vena, contracta, Hydraulic coefficients
9. Experimental Method for Hydraulic Coefficients, Discharge through a rectangular orifice
10. Flow through mouth pieces - Types of Mouth pieces - Loss of Head of a liquid flowing in a pipe, Discharge through a Mouth piece
11. Flow over Notches - Types of Notches, Discharge over a Rectangular Notch, Triangular Notch.
12. Flow over weirs - Types of weirs, Discharge over a weir, Francis's formula for Discharge over a Rectangular weir
13. Bazin's formula for discharge over a rectangular weir, velocity of approach, Discharge through a Trapezoidal weir
14. Flow through simple pipes - Loss of head in pipes, Darcy's formula for loss of Head in pipes, Chezy's formula for loss of head in pipes
15. Flow through open channels -Manning's formula, current meter
16. Pumps – Classification of pumps – Principle of working

PRACTICALS

1 Numericals on properties of fluid
2 Numericals on measurement of pressure
3 Experimental determination of pressure with Manometer
4 Verification of Bernoulli's theorem
5 Measurement of discharge with a venturimeter
6 Measurement of velocity with pitot tube
7 Numericals on Bernoulli's theorem and continuity equation
8 Determination of coefficient of discharge of rectangular weir
9 Determination of coefficient of discharge of triangular weir
10 Determination of coefficient of discharge of trapezoidal weir
11 Determination of hydraulic coefficient of orifices
12 Experiment on broad crested weir
13 Numericals on weirs
14 Determination of head losses in pipes
15 Numericals on flow through pipes and open channels
16 Practical Examination

REFERENCES

S.No	Author & Title	Publisher
1.	A Text Book of Hydraulics, V.V. Reya& D.S.P. Rao	Radiant Publishing House Book house, # 4-5-62, Women's College Road, Beside Andhra Bank, Kothi, Hyderabad-95
2.	Hydraulics and Fluid Power Systems, G. AppaRao	Radiant Publishing House Kothi, Hyderabad
3.	Hydraulics and Fluid Mechanics, Modi P M and Seth S.M. 1973	Standard Book House, Delhi

PRINCIPLES OF THERMODYNAMICS AND HEAT ENGINES

DE 164 **2 (1+1)**

Objective: To enable the students to know about the thermodynamic laws and principles, different cycles, cooling systems, fuel supply systems, lubrication systems of heat engines in general and tractors and other farm engines in particular.

THEORY

1. Thermodynamics – Thermodynamic system – Classification of thermodynamic systems- Closed system – Open system - Isolated system
2. Properties of a system – Extensive and Intensive properties – State of a system – Path of a system
3. Thermodynamic process- Quasistatic process – Reversible process- Thermodynamic cycle
4. Pressure – Atmospheric pressure – Gauge pressure – Vacuum – Absolute pressure - Temperature – Absolute temperature – Standard conditions - Volume
5. Energy forms – Energy – Stored Energy and Transit energy – Types of stored Energy – Potential energy – Kinetic energy – Internal energy – Heat – Specific heat – Work – Power – Enthalpy – Entropy.
6. Laws of thermodynamics - thermal equilibrium – Zeroth law of thermodynamics – First law of thermodynamics – Second law of thermodynamics
7. Fuels – Classification – Liquid fuels – Gaseous fuels – Properties
8. Heat engines – Types – External Combustion Engines – Internal Combustion Engines- Classification of Internal Combustion Engines based on various factors.
9. Internal Combustion Engines – Different Components – Material Construction and its functions.
10. Working cycle of 4- stroke cycle Diesel Engine - Diesel cycle
11. Working cycle of 4-stroke cycle Petrol Engine - Otto cycle
12. Working cycle of 2-stroke cycle Diesel Engine and Petrol Engine-Comparison between 4-stroke cycle Engines and 2-stroke cycle Engines-Comparison between Diesel Engines and Petrol Engines
13. Fuel Sypply System of IC Engines - Types – Components and their functions
14. Ignition system of IC Engine SI Engine - Components and their functions – Working principle of battery and Magnetic Ignition System.
15. Cooling System of IC Engine - Components and their functions – Working Principle of forced circulation cooling system

16. Lubrication System of IC Engine -Types – Components and their functions – Working principle of forced feed lubrication system.

PRACTICALS

1.	Study of different components of IC engine
2&3	Dismantling of IC Engine components
4&5	Assembling of IC engine components
6	Study the working of four stroke petrol engine
7	Study the working of four stroke diesel engine
8	Study the working of two stroke petrol engine and diesel engine
9&10	Terminology related to Engine power and its problems
11	Study the working principle of forced feed fuel supply and Ignition system
12	Study the working principle of forced feed cooling and lubrication system
13	Study thedifferent type of Dynamometers – Rope brake Test – Prony break test
14&15	Repairs and maintenance of IC Engines
16	Practical examination

REFERENCES

S.No	Author & Title	Publisher
1.	JagadishwarSahay, 1992. Elements of Agricultural Engineering	Agro Book Agency, Patna
2.	Kepner, R.A., RoyBainer and Barger, E.L., Principles of Farm Machinery	CBS Publishers and Distributors, New Delhi
3.	Michal, A.M. and Ojha, T.P. 208. Principles of Agricultural Engineering (vol.I)	Jain Brothers, New Delhi
4.	Pakirappa& V. Naresh, Thermal Engineering –I	Radiant Publishing House, 4-5-64 Book Basement, Beside Andhra Bank, Kothi, Hyderabad-95
5.	Pakirappa& V. Naresh, Thermal Engineering –II	Radiant Publishing House, 4-5-64 Book Basement, Beside Andhra Bank, Kothi, Hyderabad-95

SURVEYING AND LEVELING –I

DE-165 **3 (1+2)**

Objective: To enable student to acquire skills in the measurement of land, preparation of plans and find out their areas(regular or irregular) either for civil engineering or Agriculture Engineering related works, in general, andLand and water management works in particular by Various methods and instruments (chain,tapes,compasses plane table etc.)available commercially. Further to enable the student to take and calculate the reduced levels with the help of various leveling instruments and prepare contour maps and further estimate the cuts and fill quantities while Land leveling or grading work is take up in any agricultural field.

THEORY

1. Concept of Surveying-purpose of Surveying, Linear and angular measurements, Fundamental principles of surveying.
2. Classification of Survey based on instruments and purpose of field work – Engineering Surveys Instruments used for taking Linear and angular measurements
3. Chain Surveying-Purpose and Principle of Chain Survey - equipment used and their functions, Chains and arrows. Metallic tapes and Steel tapes, ranging rods, offset rods, pegs, plumb bob, Optical square, Line ranger.
4. Errors in ordinary chaining -Correction due to incorrect length of Chain or tape-problems
5. Different operations in Chain Surveying- Direct ranging and Indirect ranging Chaining on sloping ground –Setting out right angles with open cross staff and tape – Guidelines for Chain triangulation.
6. Recording field notes – field book-Conventional signs, Obstacles in chaining-methods to overcome obstacles.Calculations of area – different methods –Average ordinate, Trapezoidal and Simpson's rules.
7. Compass Surveying- Purpose and principle of compass Survey-description, working and uses of prismatic compass, Concept of true meridian, magnetic meridian, designation of bearings - whole Circle bearing, Quadrantal bearing - conversion of whole circle bearing to Quadrantal bearing.
8. Compass Survey –field notes - Traversing using prismatic compass.Local attraction-detection and correction.
9. Declination- conversion of magnetic bearings to true bearings- problems -calculation of included angles.
10. Plotting of Closed traverse-closing error and adjustments by Bowditch method.Errors in Compass Surveying-Personal, Instrumental and Natural.
11. Levelling- Definitions of important terms in levelling. Component parts, operations involved in levelling-Temporary adjustments of a dumpy level.Types of levelling staves.
12. Determination of reduced levels by Height of Instrument and Rise and Fall methods – Comparison – Problems.
13. Errors in levelling-Personal, instrumental and natural - Precautions

14. Classification of Levelling- Profile levelling, Reciprocal levelling-detailed description of each method – problems on reciprocal levelling.
15. Contouring – uses and Characteristics, Methods of contouring - Block contouring, Radial contouring. Interpolation of contours-tracing contour gradient- use of Contour maps
16. Uses and working principles of minor instruments- Abney level, Electronic Planimeter, Pentagraph

PRACTICALS

1. Acquaintance with the survey instruments
2. Study of a plan and map
3. Folding, unfolding of the chain and ranging a chain line
4. Measurement of distances by pace method
5. Chain triangulation survey
6. Plotting of chain triangulation
7. Chain triangulation by offset method
8. Plotting of chain triangulation by off set method
9. Cross staff survey
10. Plotting of cross staff survey

11 & 12.Tutorial class dealing the problems on errors in chaining

13. Different methods for dealing with obstacles in chaining operation

14 & 15. Study of planimeter and Computation of areas using planimeter

16 Computation of areas of irregular fields by different methods like trapezoidal and Simpson's rule

17 Study of prismatic compass and surveyor compass and accessories

18 Compass survey by intersection method and

19 Plotting of compass survey by intersection method

20 & 21. Compass survey by traverse method & Plotting of compass survey by traverse method

22 & 23. Tutorial class on bearings and its related problems

24 Acquaintance with levelling equipment

25 Booking level staff readings

26 Temporary adjustments for a leveling instrument

27 & 28. Tutorial class on reduction of levels by HI method andby Rise & Fall method

29 Study of Survey of India Toposheet

30 Grid survey

31 Study of contour map

32 Final practical examination

REFERENCES

S.No	Author & Title	Publisher
1.	Surveying and levelling Vol –1	KULKARNI and KANETKAR, Pune VidyarthiGrihaPrakashan, 1786, Sadasivpeth, Pune, 411030
2.	Surveying and Levelling Vol – 1	B.C. PUNMIA, Laxmi Publications (p) Ltd, 113, Golden house, Daryaganj, New Delhi-110002
3.	Surveying – 1	A.KAMALA, Radiant – Book house, # 4-5-62, Women's College Road, Beside Andhra Bank, Kothi, Hyderabad-95
4.	Surveying (McGrawhill)	N. N. BASAK, Tata McGraw – Hill Publishing Company Ltd, 7 West Patel Nagar, New Delhi - 110008
5.	Text Book of Surveying	C.Venkatramaiah, Universities Press (India) Limited 3-5-820, Hyderguda, Hyderabad-500 029

WORKSHOP TECHNOLOGY – II

DE-167 **3(1+2)**

Objective: To impart knowledge and skills to students in manufacturing processes of machines, tool sand equipment and hands on training on various aspects of milling grinding and drilling and foundry shop for encouraging entrepreneur development for engineering enterprises in general and farm mechanization in particular

THEORY

1. Introduction to foundry - Advantages and disadvantages of foundry – process of producing castings, hand moulding tools.
2. Pattern making – pattern materials, types of patterns.
3. Pattern allowances, colour codes for patterns, sequence in pattern making, moulding materials.
4. Classification of moulding sand – Natural moulding sands, synthetic sands, special sands; sand Binders – Clay type binders, organic type binders, inorganic type binders; sand additives.
5. Properties of moulding sand – porosity, flowability, collapsibility, Adhesiveness, cohesiveness, Refractoriness.
6. Cores – Core requirements, core sands, types of cores, core making.
7. Moulding procedure, Moulding processes, Bench moulding, floor moulding, pit moulding, machine moulding, Green sand moulding, Dry sand moulding, Skin dried sand moulding, Loam moulding, Cement Bonded moulding, carbon dioxide moulding, shell moulding, ceramic moulding.
8. Defects in castings, safety precautions in foundry shop
9. Introudction to Drilling, Working Principle of drill work, Types of drilling machines – Sensitive drilling machine, Radial drilling machine; specification of drilling machine.
10. Work holding devices – Drill press vice, parallels, V-blocks, angle plate, T-bolts, straps and step blocks. Tool holding devices –Drill chucks, Drilling machine spindle, sleeves and sockets
11. Types of drills – Flat drill, straight fluted drill, twist drill, core drill, oil tube drill and center drill. Drilling machine operations – Drilling, Reaming, Boring counter boring, counter sinking, tapping, spot facing and trepanning.
12. Introduction to lathe, functions of lathe, types of lathes and constructions detials of lathe.
13. Description and functions of lathe parts, main accessories and attachments and mechinism used in lathes.
14. Main operations and tools used in centre lathes
15. Introduction to sawing – Methods of sawing – Hand sawing, power sawing, sawing machines – Reciprocating saw, circular saw, Band saw, reciprocating saw, circular saw, Band saw.
16. Specification of power hack saw – Types of saw Blades, set patterns for saw blade teeth.

PRACTICALS

1&2	Demonstration on casting equipment and tools
3&4	Demonstration on pattern making
5&6	Mould making using one piece pattern
7&8	Mould making using two pieces pattern.
9&10	Plane turning on lathe machine
11&12	Step turning on lathe machine
13&14	Taper turning on lathe machine
15&16	Knurling operation on lathe
17	Drilling on lathe machine
18	Boring on lathe machine
19&20	External thread cutting on lathe machine
21&22	Internal thread cutting on lathe machine
23&24	Working on sensitive drilling machine
25	Working on drilling machine reaming, boring and counter boring
26	Working on drilling machine counter shinking, Tapping, spot facing and trepanning.
27	Working on power saw
28	Working on band saw
29	Working on circular saw (cold saw)
30	Visiting of local implements manufacturing units
31	Visiting of a moulding unit.
32	Final practical examination

REFERENCES

S.No	Author & Title	Publisher
1.	Elements of workshop technology, (Volume I & II)	HajraChoudhury,S.K.,HajraChoudhury, A.K. and Nirjhar Roy, 2010. MediaPromoters and Publishers Pvt. Ltd. Mumbai
2.	Workshop technology (Part I & II)	Chapman, W.A.J. 1989. Arnold Publishers (India) Pvt. Ltd. AB/Safdarjung Enclave, New Delhi.
3.	A course in workshop technology (Volume I & II)	Raghuwansi, B.S. 2003. DhanpatRai and Co. (P) Ltd. Educational and technical publishers. 1710, NaiSarak, New Delhi – 110006
4.	Manufacturing technology- I	Pakirappa and Kumar V.N. 2010. Radiant Publishing House, Hyderabad.
5.	Workshop technology	M. Anitha. Falcon Publishers, Hyderabad

II Year I Semester

AGRICULTURAL IMPLEMENTS

DE-211 **3 (2+1)**

Objective: Primary and secondary tillage implements, along with planting and Fetilizing implements will be discussed to get awareness on the mechanical part of the Agricultural Engineering.

Theory

1. Tillage – definition, objectives; classification and types of Tillage
2. Primary tillage Implements-classification indigenous plough
3&4. Animal drawn Implements and Tractor drawn Implements - Classification
5. Study of animal drawn and Tractor drawn mould board plough
6. Study of animal drawn and Tractor drawn disc plough
7. Study the methods of ploughing – Gathering and casting etc.
8&9. Terminology related to implements – draft, unit draft, side draft, centre of power, centre of resistance, pull, line of pull, field capacity and field efficiency.
10. Secondary tillage implements – classification
11. Study of animal drawn implements – guntake (Blade harrow), cultivator, spike tooth harrow and spring tyne harrow
12. Study of tractor drawn implements – cultivators – rigid and spring type cultivators
13. Study of Disc harrow – types, constructional details
14. Study of spike and spring tooth harrows – constructional details
15&16. Study of pudllers, power tiller and Tractor cage wheels puddling – objectives, types, constructional details.
17. Study of land development implements such as levellers, bund former, Ridger, constructional details.
18. Green manure trampler – constructional details
19&20. Planting and Fetilizing equipment – Methods of sowing, classification – Animal drawn and Tractor Drawn implements
21&22. Seed metering mechanism – types, constructional details - furrow openers-types.
23. Study of Animal drawn seed cum ferti drills
24&25. Study of Tractor drawn seed cum ferti drills.
26. Calibration of seed drill-seed uniformity tests.
27. Study of zero till seed drill and paddy seeder
28. Planters – Potato planter, sugarcane planter – construction details, functions and seed metering mechanism.
29. Study of Inter cultivation implements – manual, bullock and tractor drawn.
30. Study of wet land and dry land weeders – star weeder, push hoes etc.
31&32. Study of Harvesting implements – Groundnut and turmeric harvesters – principle of cutting of a crop, types of impact cutters.

Practicals

1. Study the performance of indigenous plough and mould board plough
2. Study the performance of Guntaka, cultivator and spike tooth harrow.
3. Study the constructional details and performance Testing of Mould board plough
4. Study the constructional details and performance Testing of Disc plough
5. Maintenance and adjustments of primary and secondary tillage implements.
6. Maintenance of primary and secondary tillage implements.
7. Study the constructional details of Disc harrows and cultivators.

8&9 Numerical problems related to tillage implements – Field capacity field efficiency and size of Tractor etc.

10 Study the constructional details of different types of seed drills.

11. Calibration and performance testing of seed cum fertilizer drill.
12. Operation and maintenance of seed cum fertilizer drills.
13. Numerical problems on seed cum fertilizer drills – calibration, cost of operation and field capacity etc.
14. Study the constructional details and performance testing of groundnut digger.
15. Study the constructional details and the performance testing of inter cultivation implements.
16. Final practical examination.

References

S.No	Title	Author & Publisher
1.	Elements of Agricultural Engineering	Jagdishwar Sahay Standard Publishers distributors 1705-B, NAISARAK P.Box No.1066, Newdelhi-6
2.	Principles of Agricultural Engineering-Volume I	A.M. Michael & T.P. Ojha Jain Brothers, Ratnada Road Jodhpur-342001
3.	Agricultural Engineering	O.P. Singhal Aman Publishing House Meerut-250002, U.P.

AGRICULTURAL PROCESS ENGINEERING - I

DE 231 **3(1 + 2)**

Objective: To impart knowledge and skills related to various aspects of crop processing like, cleaning, grading, sorting, drying milling including size reduction, extraction, distillation, centrifugal separation of various crops; cereals, pulses, oilseeds, etc., to minimize post harvest losses by value addition to the agricultural produce.

Theory

1 Scope and importance of crop processing – principles and methods of crop processing.
2 Cleaning and grading-definitions– principles
3 Theory of separation, types screens-screen openings, cyclone separator
4 Separator based on length, width, and shape of the grains
5 Drying- definitions- principles- psychrometry.
6 Moisture content measurement-Methods of drying –Classification-thin layer drying- deep bed drying-numericals on Moisture Content
7 Sun drying- Mechanical Drying- types of driers
8 Continuous flow driers- non-mixing column dryer- mixing (Baffle and L.S.U drier)
9 Size reduction - principles – laws – and theory – fineness modulus
10 Crushers, grinders, cutting machines
11 Study of hammer mill and attrition mill
12 Filtration equipment; plate and frame filter press , rotary filters, centrifugal filters and air filters
13 Importance of material handling devices – belt conveyor- capacity and power requirement
14 Screw conveyors – capacity and power requirement
15 Bucket elevator - capacity and power requirement-pneumatic conveyor
16 Grain storage structures- traditional structures-modern storage structures

Practicals

1. Introduction to Agricultural processing engineering Laboratory
2. Study of different types of screens
3. Measurement of different screens size, length & shape
4. Study of Cyclone separator
5. & 6. Tutorial on use of Psychrometry chart
7. Measurement of moisture content by direct method
8. Measurement of moisture content by indirect method
9. Performance evaluation of sack driers
10. Performance evaluation of Rotary driers
11. Performance evaluation of continuous flow non-mixing column driers
12. Performance evaluation of continuous flow Baffle Dryer

13&14. Performance evaluation of continuous flow mixing type driers (L.S.U)

15. Visit to local industry

16&17. Evaluation of size reduction/grinding equipment

18&19. Performance evaluation of hammer mill

20& 21. Performance evaluation of attrition mill
22 &23. Study of different mixing equipments (pasty material)
24& 25. Study of filtration equipments
26. Performance evaluation Belt conveyor
27. Performance evaluation Screw conveyor
28. Performance evaluation pneumatic conveyor
29. Performance evaluation Bucket elevator
30& 31. Performance evaluation grinding equipments
32. Practical Examination

References

1. Transport Processes and Unit Operations - Geankoplis C J 1978. Aliyn and Bacon Inc., Newton, Massachusetts
2. Unit operations in Food Processing -Earle R L 1983. Pergamon Press, New York
3. Post Harvest Technology of Cereals, Pulses and Oil Seeds - Chakravarthy A and De D S 1988. Oxford and IBH Publishing Co. Ltd., Calcutta
4. Unit Operations of Chemical Engineering - McCabe W L and Smith J C 1993. McGraw Hill Book Co., New Delhi
5. Unit Operations pf Agricultural Processing - Sahay K M and Singh K K 1994. Vikas Publishing House PVt. Ltd., New Delhi

GREENHOUSE TECHNOLOGY

DE-235 **2 (1+1)**

Objective: Constructional and operational details of greenhouses will lead the students to grow crops with profits and also to use the greenhouses for offseason usage and also to manage them commercially.

Theory

1. Greenhouses – Introduction, history, definition, greenhouse effect, advantages of greenhouses.
2. Classification of greenhouses – Greenhouse types based on shape, utility, construction and covering material.
3. Plant response to greenhouse environment – light, temperature, relative humidity, ventilation and carbon dioxide.
4. Environmental requirement for crops – Temperature requirement of horticultural crops, light requirement of crops and lighting control methods, Greenhouse shading methods, Greenhouse supplemental lighting systems.
5. Environmental control inside greenhouse – Manual controlling, thermostats, microprocessors and computerized control systems.
6. Natural and forced ventilation summer and winter cooling systems, carbon dioxide enrichment method.
7. Planning of greenhouse facility – Site selection and orientation, structural design, covering materials.
8. Materials used for construction of greenhouses – Wood, Galvanised iron pipe and glass.
9. Greenhouse covering materials – Polyethylene film, PVC, Polyester, Tefzel T^2 film, Polyvinyl chloride rigid panel, fiber glass reinforced plastic rigid panel, Acrylic and polycarbonate rigid panel.
10. Design criteria and construction details of glass and pipe framed greenhouses – Material requirement and procedure for erection.
11. Greenhouse heating and energy storage – Type of heat loss, heating systems, heat distribution systems, water and rock storage, heat conservation practice.
12. Greenhouse irrigation systems – Rules of watering, Hand Watering, perimeter watering, overhead sprinklers, Boom watering, Drip irrigation.
13. Greenhouse utilization in off season – Drying of agricultural produce.
14. Protected Agriculture Techniques – row covers.
15. Economics of greenhouse production – Capital requirements.
16. Economics of production and conditions influencing returns.

Practical

1. Study of covering and construction materials for greenhouses.
2. Measurement of environmental parameters inside greenhouse.
3. Study of construction of pipe framed greenhouses.
4. Calculation of ventilation rates – Rate of air exchange in active summer cooling system – Problems on fan and pad cooling system.
5. Rate of air exchange in active winter cooling systems – problems on convection tube cooling.

6&7. Heat requirement calculation – Heat requirement of A-frame greenhouse and Heat requirement of quonset type greenhouse – problems.

8. Study of drip irrigation system in greenhouse.
9. Estimation of drying rate of agricultural produce inside greenhouse.
10. Study of different protected Agriculture Techniques.
11. Exercise on cost economics of greenhouses.
12. Field visit to glass greenhouses.
13. Field visit to polyhouses.
14. Field visit to semi control greenhouses.
15. Field visit to fully controlled greenhouses.
16. Practical examination.

References

1. Greenhouse Technology and Management — RadhaManohar K and Igathinathane C 2000, B.S. Publication, Hyderabad
2. Greenhouse Technology — Tiwari G.N and Goyal R.K. 1998, Narosa Publishing House, New Delhi
3. The complete Book of Greenhouse Gardening — Cavendish M 1991, Marshal cavandish Books Ltd , London

SOIL AND WATER CONSERVATION ENGINEERING AND PRACTICES

DE-252 **2(1+1)**

Objective: To acquaint and equip the students with the subject of soil erosion, erosion control and water conservation measures.

Theory

1. Hydrologic cycle – Precipitation – Formation types and forms of precipitation, Measurement of rainfall and rainfall intensity.
2. Average depth of rainfall over an area – Arithmetic mean, Thiessen polygon and Iso-hyetal methods – Intensity, duration and return period relation.
3. Soil erosion – geological erosion, accelerated erosion – Agents of erosion – erosion by water, erosion by wind, and erosion by gravity.
4. Soil erosion by water – Various types of erosion by water – raindrop splash, sheet, rill, gully and stream channel erosion, Wind erosion – process description.
5. Rainfall – runoff relation – Volume and peak rate of runoff – Rational method, Hydrologic soil cover complex method – Measurement of runoff – Velocity area method, stage level recorder, hydrograph.
6. Computation of velocity of water in open channels – Manning's formula, cross section and hydraulic radius of various channel shapes – Permissible velocities.
7. Estimation of soil loss – Universal soil loss equation – Erosion control measures – agronomic measures, importance of contour farming.
8. Level and channel terraces – Design and construction of contour bunds.
9. Level and channel terraces – Design and construction of graded bunds.
10. Design of grassed waterways and diversion drains
11. Conservation structures on hill slopes- bench terraces – Design of bench terraces.
12. Conservation structures on hill slopes – Contour trenches and contour stone walls.
13. Grade stabilization structures – Design of drop spillways, drop-inlet spillways and chute spillways.
14. Water harvesting – Dugout and embankment type ponds – Design and construction of embankments for reservoirs.
15. Land capability classification.
16. Watershed – Definition, delineation, management of agricultural watersheds – brief coverage.

Practicals

1. Hydrologic cycle.
2. Problems on average depth of rainfall.
3. Problems on return period, intensity and duration.
4. Problems on rational formula.
5. Problems on hydrologic soil cover complex method.
6. Problems on contour bunds.
7. Problems on graded bunds.
8. Problems on bench terraces.
9. Problems on contour trenches and stone walls.
10. Visit to Research Farm.
11. Dugout ponds – computation of storage.
12. Embankment ponds – computation of earthwork, brief coverage on stability of embankment.
13. Land capability classification.

14&15. Design procedures for drop, drop inlet and chute spillways.

16. Visit to soil conservation works.

References

1. Hydrology and Soil Conservation Engineering — Ghanshyam Das, PHI Learning Pvt, LTD, New Delhi.
2. Land and Water Management Engineering — V.V.N. Murthy and Madan K. Jha, Kalyani Publishers, New Delhi.
3. Manual on Soil and Water Conservation — USDA, Oxford Book Company.
4. Watershed Management – Guidelines for Indian Conditions — E M Tideman, Omega Scientific Publishers, New Delhi.

COMPUTER APPLICATIONS-II

DE-261 **2(1+1)**

Theory

1. Spreadsheet, Concepts of Workbook & Worksheets
2. Using Wizards, Different Views of Worksheets, Using different features with Data, Cell and Text
3. Cell Markers, Working with Data & Ranges, Various Data Types, Name a range of cells, Cell Formatting, Conditional Formatting, Borders & Shading, Row Height, Column Width and other Format features
4. Addressing and its types (Absolute, Relative), Series, Fill series of different types ,Column & Row Freezing, Labels, Hiding, Splitting etc., Inserting, Removing & Resizing of Columns & Rows .
5. Functions and their categories like Recently Used, Financial, Logical, Text, Text, Date & Time, Lookup & Reference etc.
6. Preparing spread sheet for simple data and numeric operations. Use formulae in spread sheet operations Calculations
7. Chart Wizard, Different Chart Types , Creation of graphs, Pie charts, bar charts, Analyzing data ,Creating Formats & Links
8. Organizing Data in A List, Sorting and Filtering data, Sharing & Importing Data
9. What-if analysis using Goal Seek, Scenario, Spelling, Thesaurus, Protect Sheet, Protect Workbook, Password protection
10. Page Layout and Page formatting, Printing of Workbook & Worksheets with various options
11. About Photoshop, The Photoshop Interface, Setting up a new Photoshop document
12. The Photoshop Toolbox and Options bar, Photoshop Image and Color Basics, Opening, Creating and Saving an Image in Photoshop ,Basic image editing, Working with color in Photoshop
13. Photoshop Tools Tools - Marquees, Magic wand, Lassos,. Move tool, Crop tool, Slice tools, Pencil, Paintbrush, Eraser tools, History brushes, Gradient, Paint bucket, Burn-dodge-sponge, Blur-sharpensmudge, Shapes-line-rectangle-polygon, Path selection tool, Pen tool, Back ground and foreground.
14. Transforms : Using free transform, move, Rotate, scale, Skew, Distort, Perspective, Flip
15. Photoshop Layers and Channels and Filters, Introduction to Layers, Layer modes and blending options, Image composting using layers
16. Introduction to Channels and Actions, Filters – Artistic, Blur , Noise etc., Text editing and special effects

Practical

1. Working on Spreadsheet, Workbook & Worksheets
2. Data entering in worksheet Using Wizards, different features with Data, Cell and Text
3. Cell Formatting, Conditional Formatting, Borders & Shading, Row Height, Column Width and other Format features
4. Inserting, Removing & Resizing of Columns & Rows. Data calculation by using Financial, Logical, Text, Text, Date & Time, Lookup & Reference etc.
5. Preparing spread sheet for simple data and numeric operations.
6. Use formulae in spread sheet operations Calculations
7. Creation of graphs, Pie charts, bar charts, Analyzing data ,Creating Formats & Links
8. Organizing Data in A List, Sorting and Filtering data, Sharing & Importing Data
9. What-if analysis using Goal Seek, Scenario, Spelling, Thesaurus, Protect Sheet, Protect Workbook, Password protection
10. Page Layout and Page formatting, Printing of Workbook & Worksheets with various options
11. The Photoshop Interface, Setting up a new Photoshop document
12. The Photoshop Toolbox and Options bar, Photoshop Image and Color Basics,
13. Opening, Creating and Saving an Image in Photoshop ,Basic image editing, Working with color in Photoshop
14. Photoshop Tools - Marquees, Magic wand, Lassos. Transforms : Using free transform, move, Rotate, scale, Skew, Distort, Perspective, Flip
15. Photoshop Layers and Channels and Filters, Introduction to Layers, Layer modes and blending options, Image composting using layers
16. Practical examination

References

1. Microsoft Office 2013 Bible, Microsoft Press
2. MS OFFICE XP COMPLETE BPB publication
3. The 2007 Microsoft Office System Inside Out, Microsoft Press
4. Mastering Excel 2010, Bill Jelen, BPB
5. Mastering Microsoft Office 97 – L.Moseley, D.Boody – BPB
6. The ABSs of Microsoft Office - Professional Edition by GuyHart – Davis, BPB Publication
7. The Essential Excel 97 Book - Faithe Wempen & Donna Ppayne, Galgotia Publication
8. MS Office Excel Step by Step, Curtis Frye, Microsoft Press

SOIL MECHANICS

DE-264 **2 (1+1)**

Objective: Students will be trained on concepts and analysis of soil properties, stress conditions of loaded soil, consolidation and soil failure theories .The knowledge imparted will be used in higher level design considerations for constructions of soil and water conservation structures , irrigation and drainage structures.

1. Introduction of soil mechanics, field of soil mechanics, phase diagram, physical and index properties of soil.
2. Classification of soils, effective and neutral stress
3. Elementary concept of Boussinesq and Wester guards analysis, new mark influence chart.
4. Seepage Analysis - Quick condition-two dimensional flow-Laplace equation, Velocity potential and stream function
5. Flow net construction. Shear strength, Mohr stress circle
6. Theoretical relationship between principle stress circle, theoretical relationship between principal stress, Mohr coulomb failure theory and effective stress principle.
7. Determination of shear parameters by direct shear test, triangle test & vane shear test.
8. Numerical exercise based on various types of tests.
9. Compaction, composition of soils standard and modified protector test, abbot compaction
10. Jodhpur mini compaction test, field compaction method and control.
11. Consolidation of soil - Consolidation of soils, one dimensional consolidation spring analogy
12. Terzaghi's theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change
13. Taylor's and Casagrande's method, determination of coefficient of consolidation.
14. Earth pressure - plastic equilibrium in soils, active and passive states
15. Rankine's theory of earth pressure, active and passive earth pressure for cohesive soils, simple numerical exercises.
16. Stability of slopes - introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number.

Practical

1. Determination of water content of soil.
2. Determination of specific gravity of soil
3. Determination of field density of soil by core cutter method
4. Grain size analysis by sieving method (Dry sieve analysis)
5. Grain size analysis by hydro meter method
6. Determination of liquid limit of soil by Casagrande method
7. Determination of plastic limit

8. Determination of shrinkage limit.
9. Determination of coefficient of permeability by constant head method.
10. Determination of coefficient of permeability by variable head method.
11. Determination of compaction properties by standard proctor test.
12. Determination of shear parameters by direct shear test.
13. Determination of shear parameters by triaxial test.
14. Determination of unconfined compressive strength of soil.
15. Determination of consolidation properties of soil.
16. Practical examination

References

1	Soil Mechanics and Foundations	Punmia B C, Ashok Kumar Jain & Arun Kumar Jain – 16th edition 2005 - M/S Laxmi Publications(P)Ltd. 113, Golden House, Daryagani, New Delhi – 110002.
2	Basic and Applied Soil Mechanics	Ranjan Gopal and Rao A S R. 1993, Welley Easters Ltd., New Delhi.
3	Soil Engineering (Vol. I.)	Singh Alam. 1994, CBS Publishers and Distributions, Delhi.

SURVEYING AND LEVELING-II

DE-265 **3 (1+2)**

Objective: To enable the students to develop skills for taking up land grading and leveling of any agricultural field by plane, profile, contour adjustment, estimating the cuts and fills earthwork required to take up the work. Further to enable the students thorough with theodolite traversing, Calculation of volumes, Tacheometric surveying. To impart knowledge on electronic survey instruments for speedy and accurate survey.

Theory

1. **Contour:** Methods of contour, Interpolation of contours, tracing contour gradient marking alignments of road, Railway / canal on a contour map.
2. Capacity of reservoir using contour maps, Problems, Measurement of drainage basin area and land levelling designs.
3. **Theodolite survey:** Introduction, classification, Basic definitions.
4. Temporary adjustment of a theodolite.
5. Fundamental lines of theodolite and conditions of adjustment, Reading of vernier scales.
6. Traversing with theodolite, selection of traverse stations, Types of errors in theodolite surveying.
7. **Trigonometric levelling:** Reading of vertical angles, Measurement of vertical angles between two points A & B, Index error, Importance of reading with both faces.
8. Derivations for finding elevation and distances of the object when the object base is accessible and when the object base is inaccessible.
9. **Tacheometric surveying:** Introduction, purpose, instruments used in tacheometric systems.
10. Distance and elevation formula for horizontal line of sight in tacheometer survey, Different of tacheometric constants.
11. **Curves:** Introduction, classification, degree and radians of the curves.
12. Elements of curves, setting out circular curves by claim and Tape.
13. **Electronic survey instruments:** Principle and uses of EMD, Distomate.
14. Electronic theodolite
15. Global Position System (GPS), Digital planimeter.
16. Total station.

Practical

1. Land levelling design by plane method
2. Land levelling design by profile method
3. Land levelling design by plane inspection and contour adjustment methods.
4. Calculation of earth work volumes and reservoir capacity from contour plans.
5. Grid survey for developing a contour map.

6. Drawing of contour map (Grid method).
7. Study of transit theodolite.
8. Temporary adjustments of theodolite.
9. Measurement of horizontal angle by general method.
10. Measurement of horizontal angle by repetition method.
11. Measurement of horizontal angle by reiteration method.
12. Laying out angles in the field.
13. Traversing by the method of included angle.
14. Traversing by the method of deflection angles.
15. Theodolite traverse computations.
16. Plotting of traverse by independent co-ordinates method.
17. Calculation of areas of traverse method.
18. Reading vertical angles with transit theodolite.
19. Measurement of the height of an electrical pole.
20. Finding elevation and distance of an object.
21. Numerical problems on theodolite traverse.
22. Determination of tachcometric constants.
23. Problems on tachrometric survey.
24. Setting out a curve with chain/tape.
25. Study of digital theodolite.
26. Measurement of horizontal and vertical angles with digital theodolite.
27. Study and Practice with Global Position System in field.
28. Study of digital planimeter.
29. Measurement of a plan area using digital planimeter.
30. Study of total station.
31. Measurements with total station (distance, area and volume).
32. Final practical examination.

References

1.	A text book of surveying-II	H. Krishna Sarma, Radiant publishing houses, Hyd-95
2.	Surveying – II	A.KAMALA, Radiant – Book house, # 4-5-62, Women's College Road, Beside Andhra Bank, Kothi, Hyderabad-95
3.	Surveying for civil Engineers	S.MahaboobBasha, Anuradha Publications, Kumbakonam, Chennai
4.	Surveying (McGrawhill)	N. N. BASAK, Tata McGraw – Hill Publishing Company Ltd, 7 West Patel Nagar, New Delhi - 110008
5.	Land and Water Management	R. Suresh 2008. Standard Publishers Distributors, Delhi.
6.	Irrigation theory and practice	Michael A M 1992. Vikash publishing House Pvt. Ltd, New Delhi.

WORKSHOP TECHNOLOGY - III

DE-267 **3 (1+2)**

Objective: To impart knowledge and skills to students in manufacturing processes of machines, tools and equipment and hands on training on various aspects of production lathe, milling, shaping and planning for encouraging entrepreneur development for engineering enterprises in general and farm mechanization in particular operations.

Theory

1. Production lathes-Introduction, Difference between centre lathe and turret lathe, Types of turret lathes – Capstan lathe, saddle type lathe.
2. Work holding and tool holding devices used in turret lathe.
3. Capstan and turret lathe operations.
4. Automatic machine lathes-Automatic and semi automatic lathe, Difference between automatic and semi automatic lathe.
5. Classification of semi automatic lathes - Single spindle lathe, single spindle automatic screw machine, swiss type automatic screw machine, multi spindle lathes.
6. Shaping machine-Introduction, working principle of shaper.
7. Types of shapers-Horizontal shaper, vertical shaper and travelling head shaper, construction features, size of shaper.
8. Shaper driving mechanism-Crank and slotted lever mechanism, whit worth quick return mechanism, principle of whit worth mechanism.
9. Shaper operations and shaper tools.
10. Planning machines - Working principle, types of planers, constructional features of a standard planer, feed mechanism.
11. Work holding devices used in planer, planer operations.
12. Introduction to milling machine and types of milling machines.

13&14 Constructional details of column and knee types universal milling machine and principles of operation.

15&16 Main operations of milling machine.

Practicals

1&2 Study of turret leathe.

3,4&5 Study of automatic and semi automatic lathe.

6. Study of shaper machine.

7&8 Changing a round rod into square section.

9&10 Preparing V block.

11&12 Study of different types of planers.

13. Study of feed mechanism of planer.

14&15. Construction features of planer.

16&17. Study of different operations of planning.
18. Study of standard planer.
19. Demonstration of important operations on a milling machine.
20&21. Plane milling.
22&23. Study of column type universal milling machine.
24&25. Study of knee type milling machine.
26&27. Study of single spindle lathe.
28&29. Study of swiss type lathe and screw type lathe.
30. Study of multispindle lathe.
31. Different operations on production lathe.
32. Practical test.

References

S.No	Title	Author & Publisher
1.	Manufacturing Technology – I&II	Pakirappa and V.N. Kumar, 2nd Revised and updated edition Radiant Publishing House.
2.	Workshop Technology Part-2	Chapman W.A.J. 4th edition, Elsevier Butterworth-Heinernam Publications
3.	Elements of Workshop Technology (Vol. I & II)	HazraChoudari SK and Bose SK 1982, media promoters and publishers Pvt. Ltd., Mumbai.
4.	A course in workshop Technology (Vol. I & II)	Raghuwamsi BS 1996. DhanpatRai and Sons, 1682 NaiDarak, New Delhi.

II Year II Semester

AGRICULTURAL MACHINERY

DE-212 **3 (2+1)**

Objective: To enable the students to understand the basic principles of cutting mechanisms and to know the various harvesting machines are available. To know the working and functions of various machine parts of mowers, reapers, windrowers, forage harvesters, threshers, corn harvesters, cotton strippers, cotton pickers, groundnut and potato harvesters, combines, sugarcane harvesters. Students can also understanding the importance of testing and evaluation of agricultural machines and different standard codes available for testing in India.

Theory

1. Transplanting machinery – Types – Functions – Principle of working
2. Paddy transplanters – Types – constructional details and working
3. Grain harvesting – Principles of cutting- Impact cutters – types- Harvesting – History of development, manual harvesting, sickle and its classification -

4&5 Mowers- Types – constructional details and working principles – Alignment – Registration

6. Reaper – Types – Construction details and working principles – Reaper binder working principle – factor affecting the performance of reaper
7. Combine harvester – Types – Functions – Advantages
8. Combine harvester – Constructional details working principles of paddy combine harvester
9. Corn harvesting equipment – harvesting and development – Types – Working principle

10&11 Root crop harvesting equipment – Groundnut Harvesting – Groundnut digger – shaker and windrowers – Constructional details and working principle

12. Potato harvesting machinery- Harvesting methods and equipment.
13. Groundnut pod stripper – Groundnut thresher – Constructional details – Working principles.
14. Cotton Harvesting machinery – Types of cotton strippers – Factors effecting – Performance of cotton strippers.
15. Sugar cane Harvesting Machinery – Self propelled cane Harvester – Working principles

16 Fruit Harvesters – Harvesting methods – Types – Working principle

16&17 Chaff cutters – Types – Flywheel type chaff cutter – Constructional details and working principles and related problems

18. Power operated chaff cutter – Constructional details and working principle – Terminology – Related to chaff cutter
19. Plant protection machinery – Sprayers – Applications – Functions – Methods of applying liquid chemicals

21. Sprayers – Classification of sprayers – Non-pressure type – Low pressure type – High pressure type – Components

22&23. Manually operated sprayers – Types, Hand operated sprayer – Knapsack sprayer, compression sprayer, Foot sprayer Rocker sprayer – Constructional details and working principle.

24. Power operated sprayers – Mist Blower – High pressure motorised knapsack sprayer – Constructional details and working principle

25. Tractor mounted Boom sprayer – Constructional details and working principle

26. Types of Nozzles – Working principle – Constructional details

27&28. Dusters – Principle of dusting – Classification of dusters – Hand operated dusters – Power operated dusters – Constructional details and working principle

29. Calibration of sprayers – Calibration of Nozzle flow rate – Methods to measure the uniformity of spray.

30. Testing of Agricultural machinery – Procedure – Types of testing system – National testing – Proto type testing

31. Confidential testing – Commercial testing, batch test, series test.

32. Test codes of different Agricultural Implements and Machinery

Practical

1. Study the performance constructional details of mowers
2. Study the performance of combine harvester (Paddy)
3. Study the performance of paddy reaper and reaper binder
4. Repair and maintenance of mowers
5. Repair and maintenance of reapers
6. Study the performance of paddy transplanter
7. Operation, repair, maintenance and safety precautions of chaff cutters
8. Study the performance of Groundnut digger shaker and windrower
9. Operation, Repair, maintenance and safety precaution of sprayer.
10. Operation, Repair, Maintenance and safety precautions and dusting machinery
11. Tutorial on chaff cutters
12. Tutorial on sprayers and dusters
13. Study the performance and repair and maintenance of post hole digger
14. Operation, repair and maintenance of self propelled sugar cane harvester
15. Study the performance of groundnut pod stripper and thresher
16. Final practical examination

References

1.	Elements of Agricultural Engineering.	JagadiswarSahay (1992), Agro Book Agency, Patna
2.	Principles of Agricultural Engineering (Vol. I).	Michal, .M. and Ojha, T.P. (2008), Jain Brothers, New Delhi.
3.	Principles of Farm Machinery	Kepner, R.A., Roy Bainer and Barger, E.L. (1987), CBS Publishers & Distributors, Delhi
4.	Farm machinery and equipment	Smith H.P Tata McGraw-Hill Publishing Co.Ltd, New Delhi

AGRICULTURAL PROCESS ENGINEERING -II

DE-232 **2 (1+1)**

Objective: This course provides knowledge on various process Technologies for cereals, pulses, oilseeds and their conveying and elevating equipment to enable the students to acquire skills and to understand the various processing operations

Theory

1 Threshing – Introduction, definition, types of threshing based on feeding, components
2 Types of threshing cylinders, principle of threshing, types of threshers based on design-manual operated and mechanical operated threshers.
3 Precaution and care in operation of a thresher, terminology of thresher testing, reasons for different troubles of thresher
4 Castor Sheller and Sun flower thresher - working principle
5 Winnowing – definition, principles of winnowing, types of winnowers, winnowing fans
6 Rice Milling – definition- Rice processing – modern rice milling flowchart, layout of modern rice mill.
7 Parboiling of paddy – Introduction, advantages, disadvantages, process variables, changes in chemical constituents,
8 Rice milling –Terminology. Milling equipment – Engelberg huller, centrifugal sheller
9 Rice milling – Under-runner disk husker, rubber roll sheller, husking action of rubber rolls
10 Rice milling – Paddy separator (Satake type, Schule type), whiteners (Schele type, satake type), rice grader
11 Wheat Milling – Introduction, dry milling, unit operations (selection, blending, cleaning, conditioning/tempering, grinding/milling),
12 Maize shelling and milling – Maize shellers (spring type, cylinder type)
13 Milling of pulses – introduction– cleaning, conditioning, dehusking and splitting, polishing of dhal and grading of dhal - red gram – process technology (methods) flow charts – equipment
14 Oilseed processing - Importance – Concepts – oil expression and oil extraction
15 Processing of oilseeds – mechanical expression devices – hydraulic press - flow chart, screw press – expeller – configuration, radial and axial pressure in a barrel
16 Groundnut stripping, decortication principle, separation of kernels from shells

Practical

1 Determination of shelling efficiency of Groundnut thresher
2 Performance evaluation of power thresher,
3 Determination of shelling efficiency of Sunflower thresher
4 Determination of shelling efficiency of Castor Sheller

5 Determination of winnowing efficiency of Winnower
6 Performance evaluation of rubber roll Sheller
7 Visit to modern rice mill
8 Determination of oil content of rice bran
9 Visit to rice bran oil extraction plant
10 Determination of bulk density and porosity of grains
11 Measurement of physical properties of Wheat
12 Measurement of physical properties of Redgram
13 Determination of drying rate of grains
14 Performance evaluation of Maize Sheller
15 Performance evaluation of Groundnut decorticator
16 Practical examination

References

1	Rice Post Harvest Technology	Araullo E V De Padna D B and Graham1976. IDRC, Canada
2	Processing Equipment for Agricultural Products	Hall C W and Davis C V 1979. AVI Publishing Co.Inc., Westport, Connecticut
3	Unit Operations of Agricultural Processing	Sahay K M and Singh K K 1994. Vikas Publishing House PVt. Ltd., New Delhi
4	Post Harvest Technology Cereals, Pulses and Oilseeds	Chakravarthy A 1988. Oxford and IBH Publishing Co. Ltd. Calcutta
5	Seed Technology	Agrawal R L 1989. Oxford and IBH Publishing Co. Ltd. New Delhi

ENGINEERING PROPERTIES AND PROCESSING OF SEEDS

DE-233 **3 (1+2)**

Objective: To enable the students to understand the principles and concepts of various properties of biological materials to design various processing equipments to insure food quality and safety. They are the basis for measuring instruments and sensors.

Theory

1. Physical characteristics of different food grains – Shape, size, roundness, sphericity, porosity and surface area.
2. Rheology – Basic concepts, ASTM standard definition of terms, and rheological properties – Force deformation behaviour, stress and strain behaviour.
3. Friction – Concept, effect of load sliding velocity, friction in agricultural materials – measurement – rolling resistance, angle of internal frication and angle of repose.
4. Flow of bulk granular materials – gravity flow in bins and hoppers, Aerodynamics of agricultural products – drag coefficient frictional drag and profile drag or pressure drag and terminal velocity.
5. Application of engineering properties in handling and processing machines and in storage structures. p
6. Seed processing – Introduction, services of seed processor, contaminants of seed, physical characteristics used to separate seed.
7. Basic flow pattern in seed processing – Preparing seed for processing, Scalper- two screen single air blast scalper, Reel screen scalper and Debearder.
8. Air screen cleaner – Installation, separating action, adjustments, Innovations to improving efficiency screen dams, screen brushes, oil cloth cover, Blanking the lower end of the top screen, combination screens, clay crushing rolls, hopper feed.
9. Length separations – Disc separator, operation and adjustments, Indented cylinder separator – Variables effect the separation, cylinder speed, size of indent, trough setting, tilt of the cylinder, Adjustable retarder.
10. &11 Gravity or weight separations – Specific gravity separator, the separating action, preparation of seed for processing, parts of the machine, Adjustment of feed rate, air control, end slope, side slope and deck oscillation speed- Destoner.
12. Aspirators and pneumatic separators – Fractionating aspirator, scalping aspirator, pneumatic separator.
13. Surface texture separations – Roll mill, separating action, finite for liquids separation, magnetic separator, buck horn separator, width and thickness separations (precision grader).
14. Shape and roundness separations – spiral separator, inclined draper belt, horizontal disc separator, colour separations – electronic colour sorter.
15. Seed blending – Types- Numerical
16. Importance of material handling devices –types of conveying equipments

Practicals

1. To find shape of food grains.
2. To find size of food grains.
3. To determine bulk density of grains
4. To determine angle of repose of grains.
5. To determine particle density, true density of solid grains
6. To determine porosity of solid grains.

7&8. Study of Rheological models – Kelvin and maxwell model.

9. Study of creep – stress relaxation.

10&11. To find the coefficients of friction (internal and external) of different crops.

12&13. To study separating behavior of grain sample in a vertical wind tunnel.

14. Field visit

15&16. To find the thermal conductivity of different powders.

17&18. To determine specific heat of some food grains.

19&20. To determine impurities and invisible stress cracks in grains.

21. Fractionating aspirators.
22. To determine milling quality of paddy.
23. Study of airscreen cleaner.
24. Study of disc separator and treaters.
25. Study of indented cylinder separator.
26. Study of specific gravity separator and Destoner.
27. Study of pneumatic separator.
28. Study of roll mill and precision grader.
29. Study of spiral separator and inclined draper.
30. Study of horizontal disc separator.
31. Study of electronic colour sorter.
32. Practical examination.

References

1. Physical properties of plant and animal materials — Mohsenin NN 1986. Gordon and Breach Science publishers, New York.
2. Seed processing — B.R. Greeg, A.G. Law, S.S. Virdi, and B.S. Balls. National Seed Corportions, US aid Publications.
3. Unit operations of Agricultural Produce — KM Sahay and KK Singh

ESTIMATING AND COSTING OF FARM BUILDINGS AND STRUCTURES

DE-234 **2(1+1)**

Objective: To enable the student to understand the principles and acquire the knowledge on various aspects in farmstead design and construction and also design and construction of farm structures like dairy barns, barn for poultry, compost pit, fodder silos, farm fencing , implement shed, rural grain storage structures, silos, rural roads and septic tanks

Theory

1 Farmstead - definition and constitution – various types of buildings and structures in a farmstead.
2 Planning and layout of farmstead – location and arrangement of various farm buildings – factors effecting planning of farmstead
3 Design of animal shelters – dairy barns – stanchion barn, loose housing barn and milking parlour - equipment in dairy barns
4 Design of animal shelters – Poultry housing – Deep litter system, cage system and wire mesh floor system – brooder houses – equipment in poultry houses
5 Design of animal shelters – Sheep and goat housing – sheep and goat pens
6 Construction of farm buildings – foundation – basis for width of foundation – bearing pressure of soils –material used for foundation; Super structure – walls and columns, bearing and non-bearing walls – materials used for construction of walls and columns
7 Construction of farm buildings – roof – types of roofs , roof support structures - trusses, rafters, purlins – materials used for trusses - RCC roofs and beams ; flooring – requirements of flooring, types of floors
8 Building materials – cement – constitution of cement , properties; Lime – preparation of lime for construction – calcination and hydration, quick lime, slaked lime; sand – properties, importance of sand in construction
9 Building materials - concrete – constitution – plain and reinforced cement concrete – aggregates - Computation of quantities of constituents using Fuller's formula –curing of concrete; use of steel as building material
10 Bricks – making of bricks – quality of bricks – treatment of bricks before using in construction; Timber - various types of timber used in building construction, properties and seasoning of timber,
11 Quantity survey – Estimation of quantities of various items of construction from a drawing of a structure – center line method – detailed estimate format
12 Quantity survey – costing of various items of construction – analysis of rates – requirement of material and labour for various items of construction - abstract estimate format
13 Design of storage structures – Estimating requirement of silage – process of ensiling – various types of silos – tower, pit and trench silos – design of silo
14 Design of storage structures – grain storage – requirements of storage of grain – types of storage – bulk storage and bag storage – design of godown based on the size of bags, material to be stored, spacing of stacks etc and structure of grain bins
15 Government Schemes on promotion of dairy and poultry enterprises, rural godowns and cold storages; Farm machinery sheds – components of machinery sheds and requirement and constitution of farm workshop based on size of the farming enterprise

16 Farm fencing, roads and threshing yard – various types of fences – wire fence and power fence – estimating cost of fencing; farm roads- requirement and types of roads – water bound macadam and tar bound macadam – construction of roads. Design and construction of threshing yard

Practical

1 Knowledge on requirement of building drawing – making a sketch based on requirements of space, ventilation etc.
2 Drawing to scale of the building – plan, elevation and sectional view depicting details of foundation, walls, roof etc.
3 Design of fencing - working out cost of fence for a given area
4 Design of feed storage structure - silo
5 Study of stanchion barn
6 Study of poultry housing
7 Estimating quantities of items of construction – problems on centerline method
8 Estimating quantities of items of construction – problems on centerline method
9 Preparation of detailed estimate for a farm building
10 Preparation of detailed estimate for a farm building
11 Preparation of abstract estimate – Analyses of rates - working out rates of various items of construction
12 Preparation of abstract estimate – Analyses of rates - working out rates of various items of construction
13 Understanding of grain store structure – problems on design of godown based on bag storage
14 Understanding grain storage structure – study of bulk storage – grain bins and grain silos
15 Visit to and study of dairy farm / poultry farm
16 Visit to and study of grain storage structures

References

1. Principles of Agricultural Engineering Volume I — A M Michael and T P Ojha; (2004), Jain Brothers , New Delhi
2. Agricultural Buildings and Structures — Whitaker J ; Reston, (2002), Publishing Home, Reston, Virginia
3. Farm Buildings Design — Newbaver L W and Walker H B, (2003), Prentice Hall Inc., New Jersey
4. Indian Practical Civil Engineer's Handbook — P N Khanna; Engineers' Publishers, New Delhi

FARM POWER, SOLAR AND WIND ENERGY

DE-241 **2 (1+1)**

Objective: Concepts of utilization of non-conventional energy resources such as gasifiers, biogas, solar, wind, etc. with theoretical background will be taught to effectively utilize the energy for agricultural operations and agricultural processing activities

Theory

1. Farm power – Different Sources of Farm Power – Advantages and Disadvantages.
2. Renewable Sources of Energy – Introduction – Need of Renewable Sources of Energy – Types of Renewable Sources of Energy.
3. Solar Energy – Introduction – Solar Radiation – Solar Constant – Measurement of Solar Radiation.
4. Solar Energy Collection – Principle of conversion of solar radiation into heat – Solar collectors – Non concentrating types – Solar liquid flat plate collector – Solar air flat plate collector.
5. Concentrating collectors – Line focussing collectors – Point focussing collectors – Flat plate collector with adjustable mirrors – Advantages and limitations of concentrating collectors.
6. Solar energy storage – Methods of storing solar energy – Thermal energy storage – Sensible heat storage – Latent heat storage – Thermo chemical energy storage – Solar Pond – Working principle and description of solar pond – application of solar pond.
7. Solar Energy applications – Solar water heater – Natural circulation type – Forced circulation type – Analysis of collector and its problems.
8. Solar power generation – Low Temperature plant working on Rankine cycle – Solar space cooling – Solar Absorption Refrigeration system.
9. Solar space heating – Passive system – Active system.
10. Solar still (solar Distillation) Solar Dryer – Cabinet type dryer and convective type dryer.
11. Solar cooker – Box type cooker – Advantages and limitations.
12. Photo voltaic conversion – Solar cell – Working principle – Applications – Advantages and limitations – Conversion efficiency and current voltage characteristics of a solar cell.
13. Photo voltaic cell for power generation – Solar photovoltaic water pumping system – Solar latern – Solar street light – Solar fencing.
14. Wind energy – Introduction – Classification – Horizontal axis wind mill – Wind mill for water pumping (wind pump) – Wind mill for Electric power generation (wind turbine)
15. Vertical axis wind mill – Forces acting on the Blade
16. Wind Data and Energy Estimation – Site selection considerations – Power Coefficient – Electrical generation dry wind mill

Practical

1. The study of the instruments Pyrhelio meter and Pyranometer for the measurement of solar radiation.
2. The study of different types of solar non concentrating flat plate collectors-liquid collector and Air collector.
3. The study different types of solar concentrating collectors – Focusing and non-focusing type.
4. The study of solar pond and its applications.
5. The study of solar water heater – Natural circulation type and Forced circulation type.
6. The study of solar power generation – low temperature plant working on Rankine cycle.
7. The study of solar space cooling – Solar Absorption Refrigeration system.
8. The study of solar space heating – Passive system and Active system.
9. The study of solar still.
10. The study of solar dryers – Cabinet type dryer and convective type dryer.
11. The study of solar cooker.
12. The study of solar PV power generation and water pumping system.
13. The study of solar street light, solar latern and solar fencing.
14. The study of Horizontal Axis wind mill for water pumping and power generation.
15. The study of vertical axis wind mills for power generations and water pumping.
16. Practical examination.

References

1	Energy sources and power plant Engineering	Pakirappa and V.Naresh Second Edition (2014), Radiant Publishing House, Hyderabad
2	Biotechnology and other Alternate Technology	Chakravarthy A (1989), Oxford and IBH Publishing Co. Ltd., New Delhi
3	Renewable Energy Sources and Conversion Technology	Bansal N K, Tata McGraw Hill (1990),Publishing Co. Ltd., New Delhi
4	Solar Energy Utilization	Rai G.D. (1984) Khanna Publishers, New Delhi
5	Solar Energy	Sukatme SP, Tata McGraw Hill (1985)Publishing CO. Ltd., New Delhi
6	Non-Conventional Energy Sources	Rai, G.D. (1984) Khanna Publishers, New Delhi
7.	Energy Technology	Rao,S and Parulekar, B.B. Khanna Publishers New Delhi.
8.	Non Conventional Energy Resources	Dubey, S.K. and Bhargava S.K. DhanpatRai and Co. Delhi.

HYDROLOGY AND MANAGEMENT OF WATERSHEDS

DE-251 **2(1+1)**

Objective: to enable the students to acquire knowledge on acquifers and estimation of their different properties like hydraulic conductivity, transmissibility, storage coefficient, specific yield, leakage factor hydraulic resistance under steady and unsteady state conditions in wells dug under different aquifers, well drilling and development methods and equipment design of gravel pack in bore wells, further to make the students to acquire knowledge on various pumps available commercially their selection, operation and maintenance with due importance to find out the cost of operation.

Theory

1. Hydrology – definition, hydrologic cycle and its components, forms and types of formation of precipitation – Characteristics of rainfall in India (types of monsoon)
2. Measurement of precipitation – Recording and Non-recording rain gauges – Installation of rain gauges– Rain gauge network density for different topographic conditions.
3. Probability analysis of rainfall – Return period – Plotting position by Weibull's method, rainfall events at different probability levels (20,40,60,80%)
4. Runoff – Definition – Components of runoff – direct runoff and base flow, over land flow and interflows, pictorial representation of different routes of runoff.
5. Runoff characteristics of streams – perennial, intermittent and ephemeral streams, measurement of stream flows, catchment characteristics.
6. Measurement of stage and velocities; area – velocity method; staff gauge, point gauge, automatic stage recorders, current meters (Horizontal and vertical axis), calibration.
7. Hydrographs – Definition and components, factors affecting flood hydrographs, hydrograph separation for simple and complex storms.
8. Unit hydrograph – Concept and definition and the basic assumptions (linear response and time invariance)
9. Application of Hydrology – flood control, regulation and mitigation, land and water management, watershed management.
10. Watershed - identification and delineation; Physiographic characteristics of watershed – Area, coefficient of compactness, slope, shape factor, Drainage density, Relief, Ruggedness and hypsometric curve.
11. History of watershed management in India – Damodar Valley Corporation – Watershed projects by ICAR and Agricultural Universities- HanumanthRao Committee guidelines
12. History of watershed management in India – Watershed projects by Ministry of Agriculture and Corporation – Watershed projects by Ministry of Rural Areas and Employment – Watershed development models by non-governmental organizations – Indo-German watershed development programme in Maharastra and other states
13. Effective Resources Management in watersheds - Integrating soil and water conservation measures into watershed development

14. Participatory watershed development capacity building, social fencing, check on resources mismanagement – Principles underlying peoples participation in watershed development
15. Formulation of participatory watershed development project
16. Monitoring and evaluation of watershed projects

Practical

1. Hydrologic cycle
2. Study of recording rain gauge
3. Visit to meteorological station
4. Rainfalll probability by Weibull's method
5. Study of current meter
6. Problems on stream flow measurement
7. Analysis of runoff hydrograph
8. Computation of peak rate of runoff
9. Computation of volume of runoff
10. Problems on hydrograph
11. Derivation of unit hydrograph
12. Delineation of watershed
13. Determination of watershed characteristics
14. Visit to watershed
15. Visit to watershed
16. Practical examination

References

1	Engineering Hydrology	Subramanya K - 2013, Tata McGraw Hill Publishing Co. Ltd., New Delhi
2.	Engineering Hydrology	Raghunath H. M (1986), Viley Eastern Edition, New Delhi
3.	Hydrology and Soil Conservation Engineering	Ghanashyam Das, 2012 PHI Learing Private Limited, New Delhi
4.	Watershed Hydrology	Suresh R – (1997), Standard Publishers and distributors, New Delhi
5.	Watershed Management	DhruvaNarayana V.V., Sastry G., Patnaik U.S. – (1997) ICAR, New Delhi
6.	Watershed Management – Guidelines for Indian Conditions	Tideman E.M, Omega Scientific Publishers, New Delhi.

ENGINEERING MECHANICS AND MATERIAL TESTING

DE-262 **2(1+1)**

Objective: To enable the students for acquiring the knowledge pertaining to mechanisms and systems like theory of machine, difference between machine and mechanism, planer mechanism, kinematics chain and pair, mechanisms, types of gears and acquiring knowledge of applications of belts, chains, gears and governors etc.

Theory

1. Kinematics – definition, structure, mechanism and machine, kinematic links, pairs and chains, types of mechanism and their inversions.
2. Friction – friction in journal bearing and friction circle, friction in pivot and collar bearings, friction in clutches, ball and roller bearing.
3. Drives – Belt, Ropes And Chain Drive, classification, materials used for belts
4. Gears – classification, profile
5. Terminology of gearing, law of gearing, applications.
6. Gearing materials, efficiency of gears, gear trains
7. Gyroscope - introduction and application, expression of gyroscopic torque.
8. Inertia forces in reciprocating parts – analytical method for velocity and acceleration of piston and connecting rod.
9. Inertia forces on reciprocating parts of an engine.
10. Turning moment and flywheel – fluctuation of speed and energy, flywheel design.
11. Governors – principle, centrifugal governors, types, sensitiveness, stability and hunting of governors, types. Sensitiveness, stability and hunting in governors.
12. Brakes – mechanical, hydraulic and pneumatic brakes.
13. Dynamometers – absorption and transmission types and their application.
14. Balancing – balancing of rotating masses in single and multiple planes
15. Balancing of reciprocating masses.
16. Cams and followers – types, applications.

Practical

1. Drawing of locus of points in four bar chain and slider crank chain
2. Graphical method of finding velocity of points in mechanisms by instantaneous centre method
3. Graphical method of finding velocity of points in mechanisms by relative velocity method
4. Graphical method of finding acceleration of points in mechanisms
5. Solving of problems in friction bearings
6. Solving of problems in friction clutches
7. Solving of problems in belt transmission
8. Drawing of gear profile and solving of problems related to gear trains
9. Determination of velocity and acceleration of piston and connecting rod and forces on the reciprocating parts of the engine by analytical method
10. Solving of problems pertaining to fly wheel design
11. Solving of problems on governors, brakes and dynamometers
12. Drawing of cam profile for uniform velocity

13. Drawing of cam profile for uniform acceleration and deceleration
14. Drawing of cam profile for simple harmonic motion
15. Solving of problems on balancing of masses in single and multiple planes
16. Practical examination

References

1	Bevan Thomas. 1984..	Theory of Machines. CBS Publishers and Distributors, Delhi
2	Ballaney P L. 1985.	Theory of Machines. Khanna Publishers, 2-B Nath Market, Nai Sarak, New Delhi.
3	Rao J S and Dukkipatti R V. 1990.	Mechanisms and Machine Theory. Wiley astern Ltd., New Delhi.
4	Lal Jagdish. 1991...	Theory of Mechanisms and Machines. Metropolitan Book Co. Pvt.Ltd., 1 Netaji Subash Marg, New Delhi
5	Rattan S B. 1993.	Theory of Machines. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi

PRINCIPLES OF ELECTRICAL ENGINEERING AND FARM ELECTRICITY

DE-263 **2 (1+1)**

Objective: To impart knowledge to students on the types of electrical machines and motors and generators and power utilization techniques for efficient energy utilization

Theory

1. Introduction about charge, coulombs law of electrostatics.
2. Electric intensity or field strength.
3.& 4. Gauss's theorem, electric potential and potential difference.
5 & 6. Capacitance –capacitance equation – Types of capacitors – Uses of capacitors- Capacitors in series and parallel.
7. Dielectric strength and dielectric constant.
8. Terminology related to electrical engineering-Resistance, current, conductance, capacitance, specific resistance- etc
9. Ohm's law and limitations of ohm's law, Resistance in series, parallel and series and parallel combination.
10. Division of current in parallel circuits, Electric power and Energy-Definitions of fundamental units.
11. Conductor, insulator, semiconductor, Conducting materials - low resistivity and high resistivity and its properties – properties and applications of copper and Aluminium
12. Heating effects of Electric current – Filament or Incandescent Lamp Fluorescent lamp – Electric kettle – Electric Iron – Space heater
13. Insulating materials – Properties – Classifications
14. Farm Electricity – Use of electricity – Generation of Electricity
15. Generator, motor and alternator, Selection, Installation and maintenance of electric motors
16. Transformer – Transmission and Distribution of electric power

Practical

1. Tutorial on coulombs law.
2. Tutorial on electric intensity
3. Tutorial on electric potential and potential difference.
4. Tutorial on capacitance and dielectrics.
5 & 6. Tutorial on Ohm's law, Resistance in series, parallel and combination
7. Tutorial on capacitance in series and parallel
8. Tutorial on Division of current in parallel circuits
9. Tutorial on electric work power and energy
10. Construction of two lights in series by one switch (PVC wiring)
11. Construction of two lights in parallel by two switches (PVC wiring)
12. Study the hostel wiring
13. Study the godown wiring
14. Study the Fluorescent lamp (Tube light) wiring
15. Study the constructional details of D.C Generator and Dynamo and installation and maintenance of electric motor.
16. Practical examination

References

1.	Basic Electrical Engineering	M. Raja Lingam, Radiant Publishing house, 4-5-64, Book Basement, Koti, Hyderabad -95
2.	Elements of Agricultural Engineering	Dr.JagdishwarSahay, Standard Publishers Distributors, 1705-B NAISARAK, PO. Box. No. 1066, Delhi -06
3.	Basic Electrical Engineering	I. Ravi Kumar, Radiant Publishing house, 4-5-64, Book Basement, Koti, Hyderabad -95

THEORY OF MACHINES

DE-266 **2 (1+1)**

ObjectiveTo enable the students for acquiring the knowledge pertaining to mechanisms and systems like theory of machine, difference between machine and mechanism, planer mechanism, kinematics chain and pair, mechanisms, types of gears and acquiring knowledge of applications of belts, chains, gears and governors etc

Theory

1. Kinematics – definition, structure, mechanism and machine, kinematic links, pairs and chains, types of mechanism and their inversions.
2. Friction – friction in journal bearing and friction circle, friction in pivot and collar bearings, friction in clutches, ball and roller bearing.
3. Drives – Belt, Ropes And Chain Drive, classification, materials used for belts
4. Gears – classification, profile
5. Terminology of gearing, law of gearing, applications.
6. Gearing materials, efficiency of gears, gear trains
7. Gyroscope - introduction and application, expression of gyroscopic torque.
8. Inertia forces in reciprocating parts – analytical method for velocity and acceleration of piston and connecting rod.
9. Inertia forces on reciprocating parts of an engine.
10. Turning moment and flywheel – fluctuation of speed and energy, flywheel design.
11. Governors – principle, centrifugal governors, types, sensitiveness, stability and hunting of governors, types. Sensitiveness, stability and hunting in governors.
12. Brakes – mechanical, hydraulic and pneumatic brakes.
13. Dynamometers – absorption and transmission types and their application.
14. Balancing – balancing of rotating masses in single and multiple planes
15. Balancing of reciprocating masses.
16. Cams and followers – types, applications.

Practical

1. Drawing of locus of points in four bar chain and slider crank chain
2. Graphical method of finding velocity of points in mechanisms by instantaneous centre method
3. Graphical method of finding velocity of points in mechanisms by relative velocity method
4. Graphical method of finding acceleration of points in mechanisms
5. Solving of problems in friction bearings
6. Solving of problems in friction clutches
7. Solving of problems in belt transmission
8. Drawing of gear profile and solving of problems related to gear trains
9. Determination of velocity and acceleration of piston and connecting rod and forces on the reciprocating parts of the engine by analytical method
10. Solving of problems pertaining to fly wheel design

11. Solving of problems on governors, brakes and dynamometers
12. Drawing of cam profile for uniform velocity
13. Drawing of cam profile for uniform acceleration and deceleration
14. Drawing of cam profile for simple harmonic motion
15. Solving of problems on balancing of masses in single and multiple planes
16. Practical examination

References

1	Bevan Thomas. 1984..	Theory of Machines. CBS Publishers and Distributors, Delhi
2	Ballaney P L. 1985.	Theory of Machines. Khanna Publishers, 2-B Nath Market, Nai Sarak, New Delhi.
3	Rao J S and Dukkipatti R V. 1990.	Mechanisms and Machine Theory. Wiley astern Ltd., New Delhi.
4	Lal Jagdish. 1991...	Theory of Mechanisms and Machines. Metropolitan Book Co. Pvt.Ltd., 1 Netaji Subash Marg, New Delhi
5	Rattan S B. 1993..	Theory of Machines. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi

III Year I Semester

AGRICULTURAL ENGINEERING EXTENSION METHODS

DE-301 **1(0+1)**

Objective: To provide hands-on training and experience to students to organize meetings with farmers effectively using audio-visual aids and other extension methods and through effective communication skills for the transfer of technology from workshops to lands

Practical

1. Study of audio visual aids and its classification
2. Study of projected visual aids
3. Study of non projected visual aids
4. Visit to audio visual lab
5. Simulated exercise on communication methods
6. Planning and preparation of power point slides
7. Study of instructional aids
8. Planning and preparation of information materials namely Leaflet, folder, pamphlet
9. Planning a Extension programme
10. Organizing a group discussion
11. Conducting group discussion in class room
12. Preparation of a lesson plan
13. Preparation of lesson plan for teaching of skills
14. Handling of Over head Projector, Slide Projector, Public Address Equipment (PAE), Video Camera and LCD Projector
15. Visit to village for conducting survey
16. Practical examination

Reference

1.	Extension Education	Adivi Reddy A 1971. Sree Lakshmi Press, Bapatla
2.	Extension Communication and Management	Ray G L 1991. NayaPrakashan, Kolkatta
3.	Education and Communication for Development	Dhama O P and Bhantnagar O P 1980 Oxford and IBH Publishing Co., New Delhi
4.	Audio Visual Aids in Teaching, Training and Extension	Yella Reddy N 1998. Haritha Publishing House, Hyderabad.

PRINCIPLES OF AGRICULTURAL ECONOMICS AND BUSINESS MANAGEMENT

DE-302 **2(1+1)**

Objective: Economic principles related to agriculture give the students emphasis on farm business management, analysis of budgeting, credit analysis, market management, export strategies. Confidence in students will be strengthened to start up their individual firm.

Theory

1. Agricultural economics – Meaning, nature and scope and importance of economics and agricultural economics, micro economics and macro economics, basic economic problems.
2. Agricultural production economics – Definition, nature and scope and subject matter of agricultural production economics, objectives of production economics, relationship with other sciences.
3. Farm management – Meaning, definition, nature and scope, relationship with other science, why study farm management, farm management decisions.
4. Economic principles applied to the organization of farm business – Principles of variable proportions, principles of factor substitution.
5. Farm budgeting – Meaning, types of budget, partial budgeting, enterprise budgeting and whole farm budgeting.
6. Agricultural credit – Meaning, definition, classification of credit based on various criteria, role of credit, capital in farm business
7. Credit analysis – Economic feasibility tests, 5 ‘C’s and 5 ‘R’s of credit analysis
8. Agricultural marketing – Definition, meaning, components of a market, importance of marketing in economic development, classification of markets
9. Market functions – Meaning, assembling, packing, grading & Standardization, transportation, storage, processing, distribution, buying and selling, market finance, market intelligence, market information, risk management
10. Management – Definition, decision management, importance of management, concepts, functions of management
11. Management – Management cycle, planning, organization, direction, control, coordination, communication
12. Agri-business management – Meaning, definition, concept, distinctive features of agribusiness management, application of management principles in agri-business
13. Agro-based industries – Importance, need, procedure to be followed to setup agro-based industries, constraints in establishing agro-based industries
14. Project analysis – Project meaning, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation
15. Project appraisal techniques – Undiscounted techniques, pay back method, rate of return/return on investment, etc.
16. Discounted techniques – NPV, BCR, IRR, sensitivity analysis

Practical

1-2	Farm holding survey using structured schedules
3.	Methods of estimation of depreciation
4- 5	Economic principles applied to farm management
6- 8	Project formulation and Project evaluation techniques
9.	Profit and loss statement
10.	Balance sheet
11.	Financial test ratios
12.	Marketing channels
13.	Break even analysis
14-16	Visit to Agri-business enterprises

Reference

1.	Agricultural Economics	Subba Reddy S, Raghu Ram P, NeelakanthaSastri T V and Bhavani Devi P 2004. Oxford and IBH Publishing Co. Pvt, Ltd, New Delhi
2.	Economics of Farm Production and Management	Raju V T and Rao D V S 1990. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi
3.	Essentials of Management	Joseph L Massie 1995. Prentice-Hall of India, New Delhi
4.	Agricultural Economics and Agri-business	Omri Rawlins N 1980. Prentice-Hall Inc., New Jersey.
5.	Economic Analysis of Agricultural Projects	Gittinger Price J 1989. World Bank, John Hopkins University Press, London.

OPERATION AND MAINTENANCE OF FARM MACHINERY

DE 311 **2(0+2)**

Objectives: To impart knowledge and skill to students for attaining all important parts and working principles of all farm machinery.

PRACTICALS:

1. Dismantling of Mould board plough
2. Assembling of Mould board plough
3. Dismantling of Disc plough
4. Assembling of Disc plough
5. Dismantling Disc harrow
6. Assembling of Disc harrow
7. Dismantling of Mist blower
8. Assembling of Mist blower
9. Dismantling of Rotary tiller
10. Assembling of Rotary tiller
11. Dismantling of Knapsack sprayer
12. Assembling of Knapsack sprayer
13. Dismantling of Hand compression sprayer
14. Assembling of Hand compression sprayer
15. Dismantling of Rocking sprayer
16. Assembling of Rocking sprayer
17. Dismantling of Hand rotary duster
18. Assembling of Hand rotary duster
19. Dismantling of Mist blower cum duster
20. Assembling of Mist blower cum duster
21. Dismantling of Conoweeder
22. Assembling of Conoweeder
23. Dismantling of Taiwan sprayer
24. Assembling of Taiwan sprayer
25. Dismantling of Rocker sprayer
26. Assembling of Rocker sprayer
27. Dismantling of Blade harrow
28. Assembling of Blade harrow
29. Dismantling and Assembling of Bund former
30. Dismantling and assembling of Three tyne cultivator
31. Dismantling and assembling of Five tyne cultivator
32. Final Practical Examination

REFERENCES:

S.No	Author & Title	Publisher
1.	JagadishwarSahay, 1992. Elements of Agricultural Engineering	Agro Book Agency, Patna
2.	S C Jain & C R Rai., Farm tractor maintenance and repair	A K Jain, standard Publishers and Distributors, New Delhi

TRACTOR SYSTEMS, OPERATIONS AND MAINTENANCE

DE – 312 **3(2+1)**

Objective: To enable the students for acquiring the knowledge pertaining to systems like transmission system clutch,types of clutches,types of gear,sliding,constant mesh type tractor power out lets like P.T.O,beltpullydrawbar,traction theory Rolling resistance ,Rim pull,Crawler tractor.

THEORY

1	Introduction- history of tractor development- classification of tractors
2	Tractor components-selection of tractor
3&4	Tractor power transmission system-functions-clutch –types and its functions-necessity of clutch
5&6	Single plate clutch-multi plate clutch-dog clutch-fluid coupling clutch-constructional details- features
7&8	Tractor gear box-classification-selection and its constructional details- torque converter: components-functions
9	Differential unit and Final drive- functions of crown wheel,-differential lock-final drive
10	Tutorial related to power transmission
11	Tractor steering unit-types-working principle-components and constructional details
12&13	Tractor break systems-mechanical-hydraulic break systems- components-constructional details
14&15	Hydraulic system- functions-components-working principle-position control system-draft control systems-mixed control system-precautions , repairs and maintenance of hydraulic systems
16	Tractor hitching-hitch and control board of tractor- hitch types-drawbar hitch, three point hitch
17	Tractor control board-main switch-throttle lever-de compression lever-hour meter-light switch –temperature gauge etc and its functions
18&19	Terminology related to tractor tyre, chassis and front axle-toe in-toe out-caster angle-camber angle
20	Traction and traction theory-rolling resistance-soil pressure-wheel slip-cohesion of soil and its related problems
21&22	Mechanics of tractor chassis-forces acting on single point hitch - three point hitch -with implement and without implement-
23	Tractor centre of gravity-methods-suspension, balancing and weighing method
24	Starting and operating of a tractor-method of starting and stopping a tractor-precautions while starting and operating tractor
25	Repair, maintenance and storage of tractor
26	Periodical maintenance of tractors
27	Tools used in repair and maintenance of tractor-ring, open end spanner, sockets, rinches, pliers, hammers, punches etc
28	Tractor testing- preparation for tests-types of tests
29	Power tiller-components –power transmission- components- repair and maintenance of power tiller

30&31	Mechanical power transmission-method-belt drive, chain and sprocket drive-gear drive-types of gears-spur gear, worm gear, bevel gear, helical gear, spiral gear and its functions
32	Numericals related to mechanical power transmission

PRACTICALS:

1	To study the power transmission system of tractor
2	To study the constructional details of single plate friction clutch
3	To study the constructional details of constant sliding gear box of tractor
4	To study the constructional details of differential, differential lock and final drive system in the tractor
5	To study the constructional details of steering system in the tractor
6	To measure the toe in , caster angle, camber angle of tractor
7	To measure the wheel slip of two wheel drive tractor under load and no load conditions
8	To study the constructional details of different break systems in the tractor
9	Tutorials on gear ratios in transmission system
10	To study the tractor chassis-measurement wheel base, hitch height of tractor
11	To study the engine trouble shooting, remedial measures
12	To study the electrical system in the tractor
13	To servicing of cooling system in the tractor
14	To study the procedure for radiator flushing in different tractors
15	To study the different types of gears in mechanical power transmission
16	Practical examination

REFERENCES:

S.No	Author & Title	Publisher
1.	JagadishwarSahay, 1992. Elements of Agricultural Engineering	Agro Book Agency, Patna
2.	S C Jain & C R Rai., Farm tractor maintenance and repair	A K Jain, standard Publishers and Distributors, New Delhi

MICRO IRRIGATION PRINCIPLES AND PRACTICES

DE-321 **3(1+2)**

Objective: To impart knowledge and skills to students to design sprinkler and drip irrigation systems in order to improve water productivity of different crops and to perform economic analysis and cost estimates of micro-irrigation systems.

Theory

1. Sprinkler irrigation – Historical developments, Scenario in the World, Country and State, Adoptability and Limitations
2. Different components and functions of the sprinkler system
3. Types of sprinkler irrigation systems - Based on sprinkling mechanism, Based on portability.
4. Moisture distribution patterns under sprinkler, Effect of wind speed on working of the systems, distribution uniformity, Chrstiansen Uniformity coefficient
5. Design of sprinkler system layout, laterals and mains
6. Operation and maintenance of system, field evaluation of the system, Cost analysis.
7. Drip irrigation – Historical development, Scenario in the World, Country and State - Advantages and limitations.
8. Components of drip irrigation - Head control unit, Water carrier system, Water distribution system
9. Drip Hydraulics - Water flow in pipes, Friction and pressure losses, Coefficient of friction
10. Types of Emitters - Based on Flow regime (Reynolds number), Based on Lateral connection – Different types of fertigation equipment
11. Emitter flow Equation, Pressure variations (%) for different emitter flow variations, Emission uniformity, Distribution Uniformity and irrigation Efficiency
12. Planning and design of drip system – collection of preliminary data, Layout, crop water requirements, hydraulic design, Selection of components, Economic pipe size selection.
13. Pressure variation along pipe lines and design criteria of lateral, sub-main and main lines.
14. Installation, Operation and Maintenance of drip irrigation systems, Testing and field evaluation of the system
15. Cost estimation of drip irrigation system for row and orchards
16. Troubles and remedies in the sprinkler and drip irrigation systems

Practical

1. Study of components of sprinkler irrigation
2. Tutorial on irrigation scheduling of field crops under sprinkler irrigation
3. Study of layout of sprinkler irrigation
4. Design of sprinkler irrigation for groundnut
5. Selection of different components of sprinkler system for the layout
6. Tutorial class on design of sprinkler irrigation
7. Study of operation and maintenance of sprinkler irrigation system
8. Field visit to nearby places for studying sprinkler system
9. Field visit to nearby places for studying troubles of the sprinkler system and remedies
10. Field evaluation of distribution pattern

11. Field evaluation of uniformity coefficient
12. Cost estimation of sprinkler irrigation system for field crops
13. Economic analysis of sprinkler irrigation system
14. Study of different components of drip irrigation
15. Tutorial on irrigation scheduling of row crops under drip irrigation
16. Tutorial on irrigation scheduling for orchards under drip irrigation
17 Study of layout of drip irrigation
18. Design of drip irrigation system
19. Tutorial class on design of drip irrigation system for vegetables
20. Tutorial class on design of drip irrigation system for sugarcane
21. Tutorial class on design of drip irrigation system for Mango
22. Demonstration of fertigation using fertilizer tank
23. Demonstration of fertigation using venturi
24. Demonstration of acid treatment in maintaining the drip system
25. Demonstration of chlorine treatment in maintaining the drip system
26. Field visit to orchards under drip irrigation system
27. Field evaluation of drip irrigation system
28. Field visit to study various troubles and working out remedies in the drip irrigation system
29. Cost estimation of drip irrigation system for different crops
30. Economic analysis of drip irrigation system
31. Study of sub surface drip system
32. Practical Examination

Reference

1.	Drip irrigation	Sivanappan RK, Padma Kumari O and Kumar V 1987. Keerthi Publishing House Pvt. Ltd, Coimbatore
2.	Micro-Irrigation for Crop Production Design, Operation and Management	Freddie R. Lamm, James E.Ayars and Francis S Nakayama, 2006. Elsvier Publication, Singapore
3.	Land and Water Management Principles	R. Suresh 2008. Standard Publishers Distributors, Delhi.
4.	Principles of sprinkler irrigation	Dr. M.S. Mane and Er. B.L Ayare 2007 Jain Brother, New Delhi

WELLS AND PUMPS OPERATION AND MAINTENANCE

DE -322 **2(1+1)**

Objective: To acquire the knowledge on different irrigation wells and their maintenance. Further students get through knowledge on various pumsets (CP, SP, Solar) Operation, construction, maintenance and installation with due importance to find out the trouble cost of operation.

Theory

1. Introduction to wells and types of wells
2. Tube well- types of tube wells-based on method of construction of tube wells, advantages and disadvantages of tube wells.
3. Open wells- Limitations of open wells- open wells in unconsolidated formation-unlined wells, wells with previous lining, wells with impervious lining.
4. Dug-cum bore wells- Construction details of wells.
5. Pumping systems: Indigenous water lifts-different types, Working of Indigenous water lifting devices
6. Types of pumps – principle of pumping and classification
7. Positive displacement and variable displacement pumps
8. Reciprocating pump-principles and working
9. Centrifugal pumps:-components, principles and working
10. Total pumping head, NPSH, maximum suction lift, power requirement in pumping
11. Centrifugal pumps: performance curves
12. Centrifugal pumps: priming, pump selection, installation and trouble shooting,
13. Effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics;
14. Accessories of centrifugal pumps, multistage pumps,
15. Deep well turbine and submersible pumps
16. Mixed flow pumps, propeller pumps, axial flow pumps, jet and air lift pumps

Practical

1. Study of tube well
2. Study of open well
3. Maintenance of tube well and open well
4. Tutorial problems on cost analysis of pumping system
5. Visit to tube /bore well
6. Visit to open well
7. Study of different well development methods
8. Study of centrifugal pump construction and operation
9. Study of C.P troubles, remedies and maintenance
10. Study of submersible pump construction and operation.
11. Study of S.P troubles, remedies and maintenance.
12. Dismantling, assembling and installation of C.P
13. Dismantling, assembling and installation of S.P
14. Visit to pump sets servicing workshop
15. Study of solar pump set
16. Practical examination.

Reference

1. Water, Well & Pump Engineering — Michael AM and Khepar ST 1989. Tata McGraw Hill Publishing Co. Ltd., New Delhi
2. Irrigation Theory and Practice — Micheal AM 2008 Vikas Publishing House Pvt. Ltd., New Delhi

SOLID WASTE UTILIZATION AND BIO-ENERGY

DE-341 **2 (1+1)**

Objective: To impart the knowledge on solid waste utilization management and bio-energy development process

Theory

1. Solid waste management – common sources of waste – Different types of waste – Waste management and minimization – Recovery of energy from MSW.
2. Recycling – Recycling process – Waste Recycling management – Advantages and Disadvantages of Recycling of a product.
3. Land fill – Composting – Incineration
4. Bioenergy – Biomass – Importance of biomass – Classification of biomass properties of biomass sources and characteristics of biomass.
5. Biomass conversion technologies – principles of combustion, pyrolysis and gasification.
6. Briquetting of biomass – Briquetting machines – Types of briquetting machines – construction and working of briquetting machines – Screw type and piston crank type – uses – shredding machines.
7. Gasifiers – operating parameters for the gasifiers – processing of biomass for gasification – chemistry of gasification.
8. Gasifiers – types of gasifiers – producer gas and its utilization.
9. Construction and working of principle of fixed bed down draft, updraft, cross draft and open core gasifiers and fluidized bed gasifiers
10. Biogas – principle of biogas production – phases of anaerobic digestion – Advantages, disadvantages, utilization of biogas for cooking, lighting and running IC engines.
11. Biogas production – materials used for biogas production – Factors affecting the biogas production – site selection for biogas plant – Filling a biogas plant digester for starting.
12. Biogas plants – classification of biogas plants – Constructional details of biogas plant – KVIC and Janatha type biogas plants – Comparison between fixed dome and floating drum biogas plants.
13. Constructional details of Deenabhandu biogas plant – Maintenance of biogas plants
14. Bio fuels-raw materials – characteristics
15. Biodiesel production – Principles – Processes for production of biodiesel from Jatropha and pongamia.
16. Ethanol production from sugarcane and corn

Practical

1. Study the preparation of biomass and determine the proximate and ultimate analysis
2. Study of throat and throat less down draft gasifiers.
3. Study of updraft and cross draft gasifiers.
4. Study of fluidized bed gasifier.
5. Study of screw types of briquetting machines.
6. Study of piston crank type briquetting machines.
7. Study of constructional details and working of floating drum type biogas plant.
8. Study of constructional details and working of fixed dome type biogas plant.
9. Study of constructional details and working of Dheenabhandu biogas plant.
10. Study of biodiesel production from Jatropha and pongamia.
11. Study of ethanol production from sugarcane and corn.
12. Field visit to Biogas plants.
13. Field visit to gasifiers
14. Field visit to briquetting machines.
15. Filed visit to municipal solid waste management industry.
16. Final practical exam.

Reference

1.	Energy sources and power plant Engineering	Pakirappa and V.Naresh Second Edition 2014 – Radiant Publishing House, Hyderabad-95.
2.	Non conventional Energy Resources	Dubey S.K, and Bhargava S.K. DhanpatRai and Co. (p) Ltd., Delhi
3.	Solid and Hazardous Waste Management	Rao M.N, and Razia Sultana. B.S. Publication, Hyderabad.
4.	Non Conventional Sources of Energy	Rai GD 2004. Khanna Publishers, New Delhi
5.	Alternate sources of energy	Rathore NS 2005. ICAR Publications, New Delhi
6.	Energy Technology Non conventional, Renewable and conventional	Rao S and Parulekar, B.B. Khanna publishers, New Delhi.

STRENGTH OF MATERIALS

DE-361 **2(1+1)**

Objective: The students will have acquired knowledge about the advanced aspects of engineering mechanics like tensile stress, compressive stresses, shear forces, bending moments in beams, columns, slabs, welded joints and trusses of engineering structures for applications in the designs of the structures

Theory

1. Introduction – Stresses, Tensile, Compressive and Shear- Strains, Units- Elastic Curve- Elastic Limit – Poisons Ratio. Elastic Constants- Young's Modulus (E), Bulk Modulus (K) and Shear Modulus (G) – Relation between them.
2. Stresses in uniformly tapered circular sections- Stresses in bars of composite sections. Thermal Stresses and Strains in simple bars and composite bars
3. Methods of finding out slopes & deflections of beams, Double integration method.
4. Slope and Deflection equations of a simply supported beam with a central point load, simply supported beam with eccentric point load.
5. Simply supported beam with a uniformly distributed load.
6. Columns and struts, Euler's column theory. Assumptions of Euler's column theory, Buckling load- derivations for buckling load of a column with one end fixed other free- with one end fixed and other hinged.
7. Expression for buckling load of a column with both ends hinged- with both ends fixed. Types of end conditions of columns; ends hinged, both ends fixed, one end fixed and other is hinged & one end fixed and other end is free.
8. Limitations of Euler's formula-Rankine's formula for columns
9. Design of riveted joints. Eccentric riveted connections. Riveted joints, types of joints- strength of a rivet and riveted joint-efficiency of a riveted joint.
10. Welded joints, types of welded joints- Strength of welded joints, technical terms.
11. Design of welded joints, eccentric welded joints.
12. Propped cantilever and beams – Fixed and continuous beams-Deflection and Slope equations
13. Dams, forces acting, stressed at the base width of dams
14. Stability of dams, design of base width of dams
15. Super position theorem- Claypeyron's theorem of three moments. Application of Clayperon's theorem of three moments.
16. Moment distribution methods- Analysis of statistically indeterminate beams

Practical

1. To perform the tension test on metal specimen M.S to observe stress – strain behavior, modulus of elasticity (E), ultimate stress, permissible stress, percent elongation etc., and to study its fracture
2. To perform the tension test on metal specimen C.I. to observe stress – strain behavior, modulus of elasticity (E), ultimate stress, permissible stress, percent elongation etc., and to study its fracture.
3. To perform compression test on concrete cylinders and cubes.
4. To perform compression test on CI, MS & wood material.
5. To perform the bending test on the specimens M.S & Wooden beam.
6. To perform the bending test on the specimens Plain concrete & R.C.C. beams.
7. To determine Young's modules E of beams with the help of deflection produced at centre due to loads placed at centre
8. To determine Young's modules 'E' of beams with the help of deflection produced at centre due to loads placed at quarter point
9. To study the behavior of materials (G.I. pipes, MS, CI) under torsion and to evaluate various elastic constants.
10. To study load deflection and other properties of closely coiled helical spring in tension and compression.
11. To perform the Rockwell, Vicker and Brinell's Hardness tests on the given specimens.
12. To perform the drop hammer test, Izod Test & Charpay's impact tests on the given specimens.
13. To determine compressive & tensile strength of cement after making cubes and briquettes; To measure workability of concrete (slump test, compaction factor test)
14. To determine voids ratio & bulk density of cement, fine aggregates and coarse aggregates; To determine the fatigue strength of a given specimen.
15. To write detail report emphasizing engineering importance of performing tension, compression, bending, torsion, impact and hardness tests on the materials.
16. Practical examination

Reference

1	Strength of Materials	Khurmi R.S. 2001. S. Chand & Co., Ltd., New Delhi.
2	Mechanics of Structures (Vo-I)	Junarkar S.B. 2001. Choratar Publishing House, Anand.
3	Strengths of Materials	Ramamrutham S. 2003. Dhanpat Rai and Sons, Nai Sarak, New Delhi.

III Year II Semester

Training & Project Work

DE-371	Participatory Technology Training Program	Student will be allotted to different industries	12(0+12)
DE-372	Project Work	Project work will be assigned to group of students	8(0+8)