

**B.Tech. III & IV Semester Scheme (Agricultural Engineering)**  
**SECOND YEAR B.TECH. (III SEMESTER)**

**3 AG1 - MATHEMATICS – III**

B.Tech. (AG) 3<sup>rd</sup> Sem.  
 3L+0T

Max. Marks: 100  
 Exam Hours: 3

UNIT	CONTENTS	Hrs
I	<b>Interpolation:</b> Finite differences, various difference operators and their relationships, factorial notation. Interpolation with equal intervals; Newton's forward and backward interpolation formulae, Lagrange's interpolation formula for unequal intervals.	
II	Gauss forward and backward interpolation formulae, Stirling's and Bessel's central difference interpolation formulae.	
III	<b>Numerical Differentiation:</b> Numerical differentiation based on Newton's forward and backward, Gauss forward and backward interpolation formulae.	
IV	<b>Numerical Integration:</b> Numerical integration by Trapezoidal, Simpson's rule. Numerical Solutions of Ordinary Differential Equations: Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta methods.	
V	<b>Laplace Transform:</b> Laplace transforms of elementary functions; Basic properties of Laplace transform; Initial value theorem, final value theorem and convolution property of Laplace transform; Inverse Laplace transforms. Applications of Laplace transform to solve ordinary differential equations.	

**TEXT BOOKS/ REFERENCE BOOKS:**

SN	Name of Authors /Books /Publisher	Year of Publication
1	H.C. Saxena. Text Book of Finite Differences and Numerical Analysis, S. Chand and Co.	
2	M.K. Jain, S.R.K. Iyengar and R.K. Jain. Numerical Methods for Scientific and Engineering computation, New Age International (P) Ltd	
3	N.P. Bali and Manish Goyal. A Text book of Engineering Mathematics, Laxmi Publication Pvt. Ltd., New Delhi (VII Edition).	
4	S.P. Goyal and A.K. Goyal. Integral Transforms, Jaipur Publishing House, Jaipur.	

**3AG2 STRENGTH OF MATERIALS**B.Tech. (AG) 3<sup>rd</sup> Sem.

Max. Marks: 100

3L+1T

Exam Hours: 3

UNIT	CONTENTS	Hrs
I	<b>Fundamentals:</b> Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagram's, mechanical properties of materials, elasticity and plasticity. Shear stress. and strain, pure shear. Complementary shear. Linear elasticity and Hooke's law. poisson's ratio, volumetric strain, bulk modulus of elasticity. Elastic constants and relation between elastic moduli. Stress and strain in axially loaded members. Temperature stresses and effects.	
II	<b>Analysis of stress and strain:</b> Stress at a point, stress components. Stresses on inclined planes. Plane stress and strain. Mohr's circle representation of plain stress and strain. Principle stresses and strains, maximum shear stresses. Hooke's law for plain stress. Stresses in thin cylinder and special shells subjected to internal & external pressures.	
III	<b>Beam under Flexural Loads:</b> Bending moment and shear force, relation between load, Shear force and bending moment. Bending moment and shear force diagrams for simply supported, Cantilever and overhang beams under static loading of different types viz. point loads, Uniformly distributed loads, linearly varying loads, Pure bending.	
IV	Theory of simple bending of initially straight beams. Flexural stresses in beams. Built up and composite beams. Shear stresses in beams of rectangular, Circular and I-section. Shear formula, effect of shear strain. <b>Torsion:</b> Torsion of solid and hollow circular shafts. Non-uniform torsion.	
V	<b>Columns:</b> Buckling and stability, critical load. Euler's theory for initially straight column with different end conditions, equivalent length, Limitation of Euler's formula. Rankine's formula. column under concentric loading. Secant, Perry's and Indian standard Formulae.	

**TEXT BOOKS/ REFERENCE BOOKS:**

SN	Name of Authors /Books /Publisher	Year of Publication
1	S.B. Junarkar and H.J. Shah. (1997). Mechanics of Structures Vol.-I Charoter Publishing, Opp.- Amul Dairy, Court Road, Anand.	
2	B.C. Punmia. (1990). Strength of Materials and Mechanics of Structures, Vol-I. edition, Standard publisher distributors, Nai Sarak, New Delhi – 19.	

**3AG3 FUNDAMENTALS OF AGRICULTURE**

**B.Tech. (AG) 3<sup>rd</sup> Sem.**  
**3L+0T**

**Max. Marks: 100**  
**Exam Hours: 3**

UNIT	CONTENTS	Hrs
I	<b>Soils:</b> Definition of soil, important soil physical properties and their importance, soil inorganic colloids, their composition, properties and origin of charge, ion exchange in soil and nutrient availability, soil organic matter,	
II	Soil composition and decomposition, effect on soil fertility, soil reaction; acid, saline and sodic soils, quality of irrigation water, essential plant nutrients, their functions and deficiency symptoms in plants, important inorganic fertilizers and their mode of action in soils. <b>Agronomy:</b> Definition and scope of agronomy, classification of crops, effects of different weather parameters on crop growth and development.	
III	Soil-water-plant relationship and water requirement of crops, weeds and their control, crop rotation, cropping systems, mono-cropping, double cropping, relay cropping and mixed cropping. Introduction to cash crops- cotton, sugarcane and potato and fodder crop-berseem.	
IV	Study of following crops with reference to soil and climate requirements, seedbed preparation, improved varieties, seed rate, time and method of sowing, manuring, fertilisation, intercultural operations, weed control, irrigation, crop protection and their area, production and productivity in Rajasthan: Cereals-wheat, maize and bajra, Pulses- bengal gram, kharif pulses (green gram, black gram, and cowpea), Oil seeds- groundnut and mustard.	
V	<b>Horticulture:</b> Scope of horticulture and vegetable crops, soil and climatic requirements for fruits, vegetable and floriculture crops, improved varieties, criteria for site selection, layout and planting methods, nursery raising and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices, management of orchards, extraction and storage of vegetable seeds. Introduction to hi-tech horticulture.	

**TEXT BOOKS/ REFERENCE BOOKS:**

SN	Name of Authors /Books /Publisher	Year of Publication
1	D.K. Das. (2003). Introductory Soil Science, Kalyani Publishers, New Delhi.	
2	M.M. Rai. (1995). Principles of Soil Science, S.G. Wasani for Mac Millan India Ltd., New Delhi.	
3	K.S. Yawalkar, J.P. Agarwal and S. Bokde. (1992). Manures and Fertilizers. Mrs. Kumudini K. Yawalkar, Agri. Horti. Publishing House, 52, Bajaj Nagar-440 001.	
4	Arun Katyayan. (2002). Fundamentals of Agriculture, Kushal Publications and Distributors, A. 3/4A, Trilochan Bazar, Varanasi- 221 001 (U.P.).	
5	T.Y. Reddy and G.H.S. Reddi. (1992). Principles of Agronomy, Kalyani Publishers, New Delhi.	
6	Chattopadhyay. (1999). Text book of Horticulture. Vol. II.	
7	J.S. Bal. (1970). Fruit Production. Kalyani Publishers, New Delhi	

**3AG4 ELECTRICAL ENGINEERING**B.Tech. (AG) 3<sup>rd</sup> Sem.

Max. Marks: 100

3L+0T

Exam Hours: 3

UNIT	CONTENTS	Hrs
I	<b>D.C. Machines:</b> Characteristics curves of d.c. generators and motors, application of motors for different uses, starting and speed control of motors.	
II	<b>Transformers:</b> Phasor diagram and equivalent circuits, regulation efficiency and their determination. Open circuit, short circuit and Sumpner's test.	
III	<b>Induction Motors:</b> Polyphase induction motors – starters, equivalent circuit, effect of rotor resistance, torque-slip curves, speed control by rotor resistance, pole changing and cascading, use in industry. Single phase induction motor – starting methods.	
IV	<b>Alternators:</b> Elementary idea of armature winding. Calculation of induced e.m.f., factors affecting generating e.m.f. Open circuit, short circuit and load characteristics. Voltage regulation and its determination by synchronous impedance methods. Synchronising.	
V	<b>Synchronous Motors:</b> Methods of starting. Power angle characteristics of cylindrical rotor machine, operation of synchronous motor as a condenser and as a reactor. Applications in industries.	

**TEXT BOOKS/ REFERENCE BOOKS:**

SN	Name of Authors /Books /Publisher	Year of Publication
1	Nagrath and Kothari. Electrical Machines.	
2	Ashfaq Hussain. Fundamentals of Electrical Engineering.	

**3AG5 FARM POWER****B.Tech. (AG) 3<sup>rd</sup> Sem.****Max. Marks: 100****3L+0T****Exam Hours: 3**

<b>UNIT</b>	<b>CONTENTS</b>	<b>Hrs</b>
<b>I</b>	<b>Sources of farm power-</b> conventional and non-conventional energy sources. Classification of tractors and CI engines. Difference between CI and SI, Two stroke and four stroke engines.	
<b>II</b>	Status of tractor and power tiller industries in India. Review of thermodynamic principles of CI engines and deviation from ideal cycle. Simple numerical problems horse power calculation.	
<b>III</b>	<b>CI Engine systems:</b> Study of engine components their construction, operating principles and functions. valves & valve mechanism. Fuel, intake and exhaust, ignition, starting and electrical systems.	
<b>IV</b>	<b>IC engine fuels-</b> their properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines, Simple numerical problems on fuel combustion.	
<b>V</b>	Study of properties of coolants, anti freeze and anti-corrosion materials, lubricant types and study of their properties. Engine cooling and lubricating systems. Engine governing systems: centrifugal and pneumatic.	

**TEXT BOOKs/ REFERENCE BOOKs:**

<b>SN</b>	<b>Name of Authors /Books /Publisher</b>	<b>Year of Publication</b>
1	Liljedahl, B.J., Turnquist , P.K. Smith, W.D. and Hoki Vaketo1989. Tractor and their Power units. Jhon Wiley & Sons., New York.	
2	Jones, F.R., - Farm Gas Engines & Tractors _ Mc. Grow Hill Book Company , New York	
3	Mosses & Frost – Farm Power, John Wiley & Sons, New York.	
4	Rai & Jain – Farm Tractor Maintenance and repair, Tata McGraw Hill Publishing Co.Ltd., New-Delhi.	
5	Mathur, M.L. and Sharma, R.P. Internal Combustion Engine, Dhanpat Rai & Sons, New Delhi.	
6	Gupta, R.B. Automobile Engineering, Satya Prakashan, New Delhi.	

**3AG6 HYDROLOGY**

**B.Tech. (AG) 3<sup>rd</sup> Sem.**  
**3L+1T**

**Max. Marks: 100**  
**Exam Hours: 3**

<b>UNIT</b>	<b>CONTENTS</b>	<b>Hrs</b>
<b>I</b>	<b>Introduction; hydrologic cycle; precipitation-</b> forms, rainfall measurement, mass curve, hydrograph, mean rainfall depth, frequency analysis of point rainfall, plotting position, estimation of missing data, test for consistency of rainfall records.	
<b>II</b>	<b>interception; infiltration; evaporation; evapo-transpiration-</b> estimation and measurement; geomorphology of watersheds - stream number, stream length, stream area, stream slope and Horton's laws;	
<b>III</b>	Runoff- factors affecting, measurement; stage and velocity, rating curve, extension of rating curve; Estimation of peak runoff rate and volume; rational method, Cook's method, SCS method, Curve number method.	
<b>IV</b>	<b>Hydrograph; components, base flow separation, unit hydrograph theory-</b> unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph.	
<b>V</b>	<b>Head water flood control-</b> methods, retards and their location; flood routing - graphical methods of reservoir flood routing; hydrology of dry land areas - drought and its classification.	

**TEXT BOOKS/ REFERENCE BOOKs:**

<b>SN</b>	<b>Name of Authors /Books /Publisher</b>	<b>Year of Publication</b>
1	Ghanshyam Das. (2000). Hydrology and Soil Conservation Engineering. Prentice Hall of India, New Delhi	
2	K. Subramanya. (1993). Engineering Hydrology, Tata McGraw-Hill Publishing Company Ltd., New Delhi.	
3	R.K. Linsley, M.A. Kohler and J.L.H. Paulhus. (1983). Hydrology for Engineers, McGraw Hill International Book Company, London.	
4	H.M. Raghunath. (1988). Hydrology, Wiley Eastern Ltd., New Delhi.	
5	Ullah, Wasi, S.K. Gupta and S.S. Dalal. (1972). Hydrological Measurements for Watershed Research, Jugal Kishore and Co., Dehradun.	

**Practical III Sem**  
**3AG7 STRENGTH OF MATERIALS LAB**

**B.Tech. (AG) 3<sup>rd</sup> Sem.**  
**2P**

**Max. Marks: 50**  
**Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
1	Study of Universal Testing Machine, its part and functions.
2	Operation of U.T.M, fixing of specimen for different testing.
3	Tensile test on mild steel specimen to failure and computing, Stresses, % elongation, Contraction etc.
4	Compression test on timber.
5	Compression test on mild steel.
6	Compression test on concrete cube.
7	Determination of toughness test of mild steel, Brass and Aluminum by Charpy test.
8	Determination of toughness by Izod test for wood, Aluminum & Brass.
9	Study of torsion testing machine.
10	Performance of torsion test on circular shaft specimen.
11	Bending test on wooden beam and determination of modulus of rupture.
12	Deflection test on wooden beam.
13	Revision.
14	Revision.
15	Revision.

**3AG8 BASIC AGRICULTURE LAB**

**B.Tech. (AG) 3<sup>rd</sup> Sem.**  
**2P**

**Max. Marks: 75**  
**Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
<b>Soils:</b>	
1	Determination of electrical conductivity and pH of soil.
2	Estimation of organic carbon of soil.
3	Determination of bulk density.
4	Determination of particle density and computation of soil porosity.
<b>Agronomy:</b>	
1	Identification of crops.
2	Identification of seeds of different crops.
3	Identification of weeds.
4	Fertilizer application methods
5	Different weed control methods
6	Judging maturity time for harvesting of kharif crops
<b>Horticulture:</b>	
1	Identification and description of important fruit, flower and vegetable crops.
2	Study of different vegetable cultivation tools.
3	Practices of training and pruning in some important crops.
4	Vegetative propagation methods

**3AG9 FARM POWER LAB****B.Tech. (AG) 3<sup>rd</sup> Sem.****Max. Marks: 75****2P****Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
<b>1</b>	Introduction to different systems of a CI engine; Engine parts and functions.
<b>2</b>	Valve system – study and adjustments.
<b>3</b>	Oil & Fuel - determination of physical properties.
<b>4</b>	Study of Air cleaning system.
<b>5</b>	Study of Fuel supply system of CI engine.
<b>6</b>	Study of Cooling system: thermostat and radiator.
<b>7</b>	Study of Lubricating system.
<b>8</b>	Study of Starting and electrical system of tractor.
<b>9</b>	Study of engine performance curves.
<b>10</b>	Visit to engine manufacturer/ assembler/ spare parts agency.

**3AG10 HYDROLOGY LAB****B.Tech. (AG) 3<sup>rd</sup> Sem.****Max. Marks: 75****2P****Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
<b>1</b>	Visit to meteorological observatory.
<b>2</b>	Study of different types of rain gauges.
<b>3</b>	Exercise on analysis of rainfall data.
<b>4</b>	Double mass curve technique.
<b>5</b>	Determination of average depth of rainfall and frequency analysis.
<b>6</b>	Study of stage recorders and current meters.
<b>7</b>	Exercise on estimation of peak runoff rate and runoff volume.
<b>8</b>	Exercises on hydrograph and unit hydrograph.
<b>9</b>	Exercises on design and location of retards for channel improvement.
<b>10</b>	Exercises on flood routing problems.



**3AG11 FIELD OPERATION AND MAINTENANCE OF TRACTORS****B.Tech. (AG) 3<sup>rd</sup> Sem.****Max. Marks: 75****2P****Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
<b>1</b>	Identification and location of various systems of a tractor viz. fuel, lubrication, cooling, electrical, transmission, hydraulic and final drive system.
<b>2</b>	Familiarisation with tractor controls and learning procedure of tractor starting and stopping.
<b>3</b>	Study of driving safety rules: Road signs, traffic rules, road safety, driving and parking of tractor.
<b>4</b>	Familiarisation with different makes and models of tractors in India.
<b>5</b>	Forward and reverse tractor driving practice.
<b>6</b>	Tractor driving practice with two wheeled tractor trailer forward and reverse.
<b>7</b>	Familiarisation with tools and equipment used for maintaining and servicing of tractors and farm machines; Doing the 10-hours service jobs and Maintenance after 50- hours of operation; Maintenance after 100 hours of operation; Maintenance after 250 hours of operation; Maintenance after 500 hours and 1000 hours of operation.
<b>8</b>	Dismantling and assembling of major engine parts.
<b>9</b>	Visit to tractor/ engine repair workshop.

**SECOND YEAR B.TECH. (IV SEMESTER)**

**4AG1 FLUID MECHANICS**

**B.Tech. (AG) 4<sup>th</sup> Sem.**  
3L+1T

**Max. Marks: 100**  
**Exam Hours: 3**

UNIT	CONTENTS	Hrs
I	<b>Hydrostatics:</b> Fluid Properties, Measurement of liquid pressure. Pascal's law fluid pressure on plane and curved stationary surface, Centre of pressure, Principal applications ( preliminary ) in simple gales and tanks	
II	<b>Fluid motion:</b> type and patterns, velocity and acceleration of fluid, continuity equation, elementary concept of velocity potential. Stream function and flow nets.	
III	Euler's equation of motion, integration of Euler's equation to give Bernoulli's equation for compressible and incompressible fluids. Euler's equation of motion. Integration of Euler's equation to give Bernoulli's equation for compressible and incompressible fluids, applications of Bernoulli's equation.	
IV	<b>Impulse momentum equation:</b> introduction, Force on pipe bends. Flow through sharp edged orifices, flow through mouth pieces (steady flow condition). Discharge measurement in pipes and open channels: Venturimeter, orificemeter. Nozzle and pitot tube (steady flow condition). Flow over weirs, and notches (steady flow condition).	
V	Flow through pipes: Various types. Velocity distribution. Loss of head due to friction. Minor losses, hydraulic gradient, pipes in series and parallel. Open Channel Flow: Various types, flow equations, geometrical properties of sections, Most economical section.	

**TEXT BOOKs/ REFERENCE BOOKs:**

SN	Name of Authors /Books /Publisher	Year of Publication
1	Jadish Lal, Hydraulics. (1986). Metropolitan Book Co. Pvt. Ltd., Delhi.	
2	P.N. Modi and S.M. Seth. (1995). Hydraulic and Fluid Mechanics, Standard Book House, Delhi-6.	
3	R.K. Bansal. Fluid Mechanics & Machine.	

**4AG2 SURVEYING****B.Tech. (AG) 4<sup>th</sup> Sem.****Max. Marks: 100****3L+0T****Exam Hours: 3**

<b>UNIT</b>	<b>CONTENTS</b>	<b>Hrs</b>
<b>I</b>	<b>Plane table surveying:</b> Description, construction and use of various accessories and centring, leveling and orientation. Method of plane table: Radiation, Intersection, Traversing & resection. Two Point problems and their solution by Different methods. Three point problems and their solution by different methods, Great circle method. Advantages and disadvantages of plane table.	
<b>II</b>	Description, construction and use of Theodolite, Temporary adjustments of Theodolite, Fixing, Centring, leveling and elimination of parallax. various axes and their relationship. Principles of Tacheometric survey and its field application. Constants of Tachometer. Staff held vertical and inclined. Use of Analytical lens, calculation of R.L. Use of stadia cross wires.	
<b>III</b>	Contours, contouring and their characteristics. Methods of contour surveying by Theodolites. Methods of contour surveying by Tachometer. Contour Drawing by different methods.	
<b>IV</b>	Area calculation of regular boundaries by mathematical formulas. Use of Trapezoidal and Simpson's formula, their limitation. Planimeter: Its construction use and theory, Area calculations, Use of zero circle and solution of numerical Problems.	
<b>V</b>	Computation of volumes, Earth work calculations. Level, Two level and Three level sections. Calculation of volume by the use of contour and their use in computing the reservoir capacity.	

**TEXT BOOKS/ REFERENCE BOOKS:**

<b>SN</b>	<b>Name of Authors /Books /Publisher</b>	<b>Year of Publication</b>
1	T.P. Kanetker & S.V. Kulkarni. (1990). Surveying and Leveling Vol. I & II Pune Vidyarthi Griha, Prakashan, Pune – 30.	
2	B.C. Punmia. (1990). Surveying and Field work Vol. I & II Laxmi Publications, New Delhi.	

**4AG3 FOOD PROCESS ENGINEERING**

**B.Tech. (AG) 4<sup>th</sup> Sem.**  
**3L+1T**

**Max. Marks: 100**  
**Exam Hours: 3**

<b>UNIT</b>	<b>CONTENTS</b>	<b>Hrs</b>
<b>I</b>	Introduction to food engineering, units and dimensions, introduction to mass and energy balance, simple food processing operations, problems based on of mass and energy balance of simple food processing operations.	
<b>II</b>	Heat transfer in food processing, conduction, conduction through bodies in series and parallel, convection, overall heat transfer coefficients, natural and forced convection. Introduction to Psychrometry, psychrometric properties, psychrometric chart, various psychrometric processes, application of psychormetry in simple food processing operations.	
<b>III</b>	Cleaning and Grading, screening, types of screen, grain size, particle motion on screen, screen opening, ideal and actual screen, screen analysis, fineness modulus, effectiveness of screen. Equipments for cleaning, grading and separations, air screen cleaner, disc separator, indented cylinder separator, spiral separator, specific gravity separator, cyclone separator.	
<b>IV</b>	Size reduction, Principal of size reduction, crushing efficiency, energy requirement in size reduction, power requirement in size reduction by Kick's Rittinger's and Bond's laws, size reduction procedures, size reduction equipments, crushers, grinders, attrition mills, hammer mill, cutting machines, performance of size reduction machines. Introduction to Mixing: Theory of mixing, types of mixtures for dry and paste. materials, rate of mixing and power requirement, mixing index.	
<b>V</b>	Scope & importance of material handling devices, study of different types of material handling devices such as belt, chain, screw conveyor, bucket elevator, pneumatic conveying- design consideration, capacity and power requirement.	

**TEXT BOOKs/ REFERENCE BOOKs:**

<b>SN</b>	<b>Name of Authors /Books /Publisher</b>	<b>Year of Publication</b>
1	K K Singh and K.M. Sahay. (1996). Unit Operations in Agricultural Processing. Vikas Publishing House, New Delhi.	
2	S. Henderson and S.M. Perry. (1976). Agricultural Process Engineering. 5th ed. AVI Publishing Co. Inc.	
3	McCabe and Smith. Unit Operations in Chemical Engineering, McGraw Hills Book Co.	

#### 4AG4 THEORY AND DESIGN OF MACHINES

**B.Tech. (AG) 4<sup>th</sup> Sem.**  
**3L+1T**

**Max. Marks: 100**  
**Exam Hours: 3**

UNIT	CONTENTS	Hrs
I	<p><b>Mechanisms:</b> Elements, links, pairs, kinematic chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions.</p> <p>Gear: Types of gears. Law of gearing, Involute and cycloidal profile for gear teeth. Spur gear, nomenclature. Interference and undercutting. Introduction to helical, spiral, bevel and worm gear.</p> <p>Gear Trains: Simple, compound, reverted, and epicyclic trains. Determining velocity ratio by tabular method.</p>	
II	<p><b>Power Transmission:</b> Belt drives, types of drives, belt materials. Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. Effect of centrifugal tension, creep and slip on power transmission. chain drives.</p> <p>Flywheel: Turning moment diagrams, co-efficient of fluctuation of speed and energy, weight of flywheel, flywheel applications.</p>	
III	<p><b>Friction:</b> Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, anti friction bearings.</p> <p>Introduction: Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration.</p>	
IV	<p><b>Design of joints:</b> Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear (eccentric loading not included).</p> <p>Design of shafts: Design of shafts under torsion and combined bending and torsion.</p>	
V	<p>Design of keys. Design of muff or sleeve, and rigid flange couplings. Design of flat belt drives.</p> <p>Design of brackets, levers.</p> <p>Design of helical and leaf springs</p>	

#### TEXT BOOKS/ REFERENCE BOOKS:

SN	Name of Authors /Books /Publisher	Year of Publication
1	Joseph E. Shigley and John J. Uicker, Jr. Theory of Machines and Mechanisms (International Edition), McGraw Hill Inc.	
2	R. S. Khurmi and J. K. Gupta. Theory of Machines, S. Chand & Co. Ltd., New Delhi.	
3	P. L. Ballaney. Theory of Machines, Khanna Publishers, Delhi.	
4	Joseph Edward Shigely. Mechanical Engineering Design, McGraw Hill Book Company, Singapore.	
5	P.C. Sharma & D.K. Aggarwal. Machine Design, S.K. Kataria & Sons, Delhi.	
6	R. S. Khurmi and J. K. Gupta. A Text Book of Machine Design, S. Chand & Co. Ltd., New Delhi.	

**4AG5 SOIL AND WATER CONSERVATION ENGINEERING**

**B.Tech. (AG) 4<sup>th</sup> Sem.**

**Max. Marks: 100**

**3L+0T**

**Exam Hours: 3**

UNIT	CONTENTS	Hrs
I	<b>Introduction; soil erosion:</b> Causes, types and agents of soil erosion; water erosion - forms of water erosion, mechanics of erosion; gullies and their classification, stages of gully development; soil loss estimation - universal soil loss equation and modified soil loss equation, determination of their various parameters;	
II	<b>Erosion control measures:</b> Agronomical measures - contour cropping, strip cropping, mulching; mechanical measures - terraces - level and graded broad base terraces and their design, bench terraces & their design, layout procedure, terrace planning.	
III	<b>Bunds-</b> contour bunds, graded bunds and their design; characteristics of contours and preparation of contour maps; land use capability classification; Gully and ravine reclamation - principles of gully control - vegetative and temporary structures;	
IV	<b>Wind erosion:</b> Factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, wind erosion control measures - vegetative, mechanical measures, wind breaks & shelter belts, sand dunes stabilization; sedimentation - sedimentation in reservoirs and streams, estimation and measurement, sediment delivery ratio, trap efficiency;	
V	Grassed water ways and their design; introduction to water harvesting techniques; introduction to stream water quality and pollution.	

**TEXT BOOKS/ REFERENCE BOOKS:**

SN	Name of Authors /Books /Publisher	Year of Publication
1	V.V.N. Murty. (1988). Land and Water Management Engineering, Second Edition Kalyani Publishers, New Delhi.	
2	A.M. Michael and T.P. Ojha. (1999). Principles of Agricultural Engineering, Vol. II, Third Edition, Jain Brothers, New Delhi.	
3	Gurmel Singh, C. Venkataraman, G. Sastri and B.P. Joshi. (1991). Manual of Soil & Water conservation Practices, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.	
4	G.O. Schwab, D.D. Frangmier M.J. Elliot and R.K. Frevert. (1995). Soil and Water Conservation and Engineering, Fourth edition, John Wiley & Sons Inc.	
5	P.K. Singh. (2000). Watershed Management (Design and Practice), e-media publications, Udaipur.	
6	R. Suresh. (2002). Soil and Water Conservation Engineering, Fourth Edition Standard Publishers and Distributors, Delhi.	
7	Raj Vir Singh. (2003). Watershed Management, Second Edition, Yash Publishing, Bikaner	

**4AG6 HEAT AND MASS TRANSFER**B.Tech. (AG) 4<sup>th</sup> Sem.

Max. Marks: 100

3L+0T

Exam Hours: 3

UNIT	CONTENTS	Hrs
I	Introductory concepts, modes of heat transfer, thermal conductivity of materials, measurement. Conduction: General differential equation of conduction. One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation. Electrical analogy. Insulation materials, critical thickness of insulation. Fins.	
II	<b>Convection:</b> free and forced convection. Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free and forced convection. Useful non dimensional numbers and empirical relationships for free and forced convection. Introduction to thermal boundary layer.	
III	<b>Radiation:</b> Introduction. Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor.	
IV	<b>Heat Exchangers:</b> Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers.	
V	Introduction to Mass Transfer: Steady state molecular diffusion in fluids at rest and in laminar flow. Flick's law, mass transfer coefficients. Reynold's analogy.	

**TEXT BOOKS/ REFERENCE BOOKS:**

SN	Name of Authors /Books /Publisher	Year of Publication
1	S. Domkundwar. A Course in Heat & Mass Transfer, Dhanpat Rai & Sons, Delhi.	
2	D.S. Kumar. Heat and Mass Transfer, SK Kataria & Sons, Delhi.	
3	J. P. Holman. Heat Transfer, McGraw Hill.	
4	S.P. Sukhatme. A Text Book on Heat Transfer, Orient Longman	

**4AG7 FLUID MECHANICS LAB****B.Tech. (AG) 4<sup>th</sup> Sem.****Max. Marks: 75****2P****Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
1	Study and use of pressure gauge.
2	Study & use of manometer.
3	Determination of CC for orifices.
4	Determination of CV for orifices.
5	Determination of Cd for orifices.
6	Calibration of a Venturimeter.
7	Calibration of V notch.
8	Calibration of Rectangular notch.
9	Determination of friction for pipe
10	Velocity distribution in channel cross section.
11	Field visit.
12	Field visit.
13	Revision.
14	Revision.

**4AG8 SURVEYING LAB****B.Tech. (AG) 4<sup>th</sup> Sem.****Max. Marks: 75****2P****Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
1	Setting up of plane table, use of various accessories and practice for orientation and charge of Point.
2	Radiation and intersection method of plane tabling.
3	Two point problem and its solution, three point problem and its solution.
4	Contouring by plane table method.
5	Conducting contour survey in different area their compilation.
6	Study of theodolite, fixing on stand and temporary adjustment, Permanent adjustment of theodolite and their checking.
7	Horizontal and vertical angle measurements by theodolite.
8	Problems of height and distance.
9	Use of tachometer with inclined sight and staff held inclined.
10	Contouring by grid method.
11	Contouring by radial line method.
12	Contouring by spot level method.
13	Practice of contour plotting by various methods.
14	Use of planimeter, finding constants and calculation of areas of irregular boundaries.
15	Introduction of total station.



**4AG9 FOOD PROCESSING ENGINEERING LAB****B.Tech. (AG) 4<sup>th</sup> Sem.****Max. Marks: 75****2P****Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
1	Determination of fineness modulus.
2	Determination of uniformity index.
3	Determination of effectiveness of screens.
4	Study of cyclone separator.
5	Study of air screen cleaner.
6	Study of indented cylinder separator.
7	Study of specific gravity separator.
8	Study of hammer mill.
9	Study of attrition mill.
10	Study of various cleaning equipment.
11	Study of belt conveyor.
12	Study of bucket elevator.
13	Study of screw conveyor.

**4AG10 SOIL AND WATER CONSERVATION ENGINEERING LAB****B.Tech. (AG) 4<sup>th</sup> Sem.****Max. Marks: 75****2P****Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
1	Study of soil loss measurement techniques.
2	Study of details of Coshocton wheel and multi-slot runoff samplers.
3	Determination of sediment concentration through oven dry method.
4	Problems on Universal Soil Loss Equation.
5	Preparation of contour map of an area and its analysis.
6	Design of vegetative waterways; Design of contour bunding system.
7	Design of graded bunding system.
8	Design of various types of bench terracing systems.
9	Determination of rate of sedimentation and storage loss in reservoir.
10	Design of Shelter belts and wind breaks.

**4AG11 HEAT AND MASS TRANSFER LAB**

**B.Tech. (AG) 4<sup>th</sup> Sem.**

**Max. Marks: 50**

**2P**

**Exam Hours: 2**

<b>SN</b>	<b>CONTENTS</b>
<b>1</b>	To measure thermal conductivity of metal bars.
<b>2</b>	To measure thermal conductivity of insulating powders.
<b>3</b>	To study temperature distribution along the length of fin in natural and forced convection.
<b>4</b>	Experiment on heat transfer in forced convection.
<b>5</b>	Experiment on heat transfer in natural convection.
<b>6</b>	To determine emissivity of given surface.
<b>7</b>	To determine Stefan-Boltzman constant and verify the law.
<b>8</b>	To determine rate of heat transfer, LMTD and overall heat transfer coefficient for parallel flow heat exchanger.
<b>9</b>	To determine rate of heat transfer, LMTD and overall heat transfer coefficient for counter flow heat exchanger.