CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

SCHEME OF TEACHING AND EXAMINATION

BE (AGRICULTURAL ENGINEERING) IV SEMESTER

S. No.	Board of Study	Subject Code	Subject	Periods per week			Scheme of Exam Theory/Practical			Total Marks	Credit L+(T+P/2)
				L	T	P	ESE	CT	TA		
1	Agri. Engg	394451 (94)	Watershed hydrology	4	1	-	80	20	20	120	5
2	Agri. Engg	394452 (94)	Soil and water conservation structures	3	1	-	80	20	20	120	4
3	Agri. Engg	394453 (94)	Crop process, Drying storage engineering	4	1	-	80	20	20	120	5
4	Mech. Engg	394454 (37)	Engineering Thermodynamics	4	1	-	80	20	20	120	5
5	Mech. Engg	394455 (37)	Numerical Analysis & Computer Programming (C & C++)	4	1	-	80	20	20	120	5
6	Civil Engg	394456 (20)	Soil mechanics	4	1	-	80	20	20	120	4
7	Civil Engg.	394461 (20)	Soil mechanics Lab	-	-	2	40	-	20	60	1
8	Agri. Engg	394462 (94)	Agricultural Topography & Land Measurement lab	-	-	2	40	-	20	60	1
9	Agri. Engg	394463 (94)	Crop process, Drying storage engineering Lab	-	-	2	40	-	20	60	1
10	Mech. Engg	394464 (37)	Numerical Analysis & Computer Programming (C & C++) Lab	-	-	2	40	-	20	60	1
11	Humanities	394465 (46)	Health, Hygiene & Yoga	-	-	2	-	-	40	40	1
12			Library	-	-	1	-	-	-	-	-
Total				**23**	**6**	**11**	**640**	**120**	**240**	**1000**	**33**

L – Lecturer T- Tutorial,
P – Practical, ESE – End Semester Exam, CT – Class Test
TA – Teacher's Assessment

Note: (1) Duration of all theory papers will be of Three Hours.

Note: (2) Industrial Training of six weeks in mandatory for B.E. student. It is to be completed in two parts. The first part will be in summer after IV sem. after which students have to submit a training report which will be evaluated by the college teachers during B.E. V sem.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Watershed Hydrology**	Code:	**394451 (94)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**Ten (Minimum)**
Class Tests:	**Two (Minimum)**	Assignments:	**2 (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks:80**	**Minimum Marks: 28**

Course Objectives:

- To be familiar with Hydrologic cycle, Precipitation-forms and Weather systems for precipitation
- To be familiar with analysis of rainfall
- To be familiar with Geomorphology of watersheds
- To be familiar with Stream flow and Floods and their management.

UNIT I :	Introduction, Hydrologic cycle, Precipitation-forms, Weather systems for precipitation, Characteristics of precipitation in India; Rainfall measurement, rain gauge network, optimum number; Representation of rainfall data-Mass curve, hyetograph, Moving average curve etc; Mean precipitation over an area-Different methods.
UNIT II :	Frequency analysis of point rainfall, Calculation of rainfall return period and probability, plotting position; Estimation of missing data, test for consistency of rainfall records; Double mass curve technique; Abstractions from precipitation-interception; Depression storage; infiltration; evaporation; evapo-transpiration – estimation and measurement; Reservoir evaporation-methods of reduction, Infiltration indices.
UNIT III :	Geomorphology of watersheds – stream number, stream length, stream area, stream slope and Horton's laws; Runoff – factors affecting, measurement; Runoff characteristics of streams, estimation of peak runoff rate and volume; Rational method, Cook's method, SCS Curve number method.
UNIT IV :	Stream flow- measurement of stage and velocity, rating curve, extension of rating curve; Hydrograph; components, Factors affecting the shape of hydrograph, base flow separation, unit hydrograph theory-Assumptions, applications, derivation of unit hydrographs, unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph.
UNIT V :	Floods-Terms and definitions, Head water flood control – methods, retards and their location; flood routing – graphical methods of reservoir flood routing; Channel routing- Muskinghum method; Hydrology of dry land areas – drought and its classification; introduction to watershed management and planning.

Text books:

1. Chow , V.T.(1964). Hand Book of Applied Hydrology. Mc. Graw Hill, New York.
2. Linsley, R.K. Kohler, M.A., and Paulhus, J.L.H. (1984). Hydrology for Engineers.McGraw Hill Pub.Co.Japan.

Reference books:

1. Raghunath, H.M.(2006). Hydrology-Principles, Analysis and design.New age International (P) Ltd.
2. Singh, V.P.(1992). Elementary Hydrology.Prentice Hall India.
3. Subrahmanya, K.(1987) . Engineering Hydrology.Tata McGraw Hill Pub.Co. New Delhi.

Course Outcome:

After studying the contents of the syllabus in detail the students will be able to

1. Apply knowledge to design water shed structures.
2. Demonstrate creativeness in designing new systems, components and processes in the field of engineering in general and agricultural engineering in particular.
3. Identify, analyse, and solve engineering problems useful to the society.
4. Work effectively with engineering and science teams as well as with multidisciplinary designs.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Soil and Water Conservation and Structures**	Code:	**394452 (94)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**Ten (Minimum)**
Class Tests:	**Two (Minimum)**	Assignments:	**2 (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks:80**	**Minimum Marks: 28**

Course Objectives:

- To be familiar with soil and water conservation techniques, reasons for Soil erosion its causes, types and agents
- To learn methods of soil erosion and control and water conservation
- To learn about the design of conservation structures and spillways

UNIT I	Soil erosion – causes, types and agents of soil erosion; water erosion – forms of water erosion, mechanics of erosion; Effect of slope, slope length, soil, vegetation, topographical features and rainfall on 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.
UNIT II	erosion control measures agronomic measures – contour cropping, strip cropping mulching; mechanical measures – terraces – level and graded broad base terraces and their design, bench terraces and their design, layout procedure, terrace planning, bunds – contour bunds, graded bunds and their design; gully and ravine reclamation – principles of gully control – vegetative and temporary structures; control measures for stream band and coastal erosion.
UNIT III	Landslides-factors causing it, land slips, Measures for control; Sedimentation-sedimentation in reservoirs and streams; Estimation and measurement, sediment delivery ratio, trap efficiency; Land use capability classification; Grassed waterways and their design; Introduction to water harvesting techniques; introduction to stream water quality and pollution. Use of Geotextiles in soil and water conservation. Wind erosion – factors affecting wind erosion, mechanics of wing erosion, soil loss estimation, wind erosion control measures – vegetative, mechanical measures, wind breaks and shelterbelts, sand dunes stabilization.
UNIT IV	Classification of conservation structures, functional requirements of soil erosion control structures; flow in open channels-types of flow, state of flow, regimes of flow, energy and momentum principles, specific energy and specific force, flow transitions due to hump and width variations; hydraulic jump and its application, type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy; straight drop spillway – general description, functional use, advantages and disadvantages, structural parts and functions; components of spillway, hydrologic and hydraulic design, free board and wave free board, aeration of weirs, concept of free and submerged flow.
UNIT V	Structural design of a drop spillway-loads on headwall, variables affecting equivalent fluid pressure, determination of saturation line for different flow conditions, seepage under the structure, equivalent fluid pressure, triangular load diagram for various flow conditions, creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension; chute spillway-general description and its components, hydraulic design, energy dissipaters, design criteria of a SAF stilling basin and its limitations, drop inlet spillway-general description, functional use, design criteria; design of diversions; small earth embankments-their types and design principles, farm ponds, percolation ponds, check dams and reservoirs. Environmental impact assessment.

Text books:

1. Chow, V.T. (1957). Open Channel Hydraulics. McGraw Hill.
2. Dhruvanarayana, V.V.(1993). Soil and Water Conservation Research in India. ICAR, New Delhi

Reference books:

1. Schwab, G.O. Frevert, R.K., EdministerT.w., and Barnes, K.K. (1993). Soil and water conservation engineering. John Wiley and sons.
2. Singh, G. (1985). Manual of Soil and water conservation Practice in India. Central Soil and water conservation Research and training institute, Dehradun.

Course Outcome:

After studying the contents of the syllabus in detail the students will be able to

1. Apply knowledge to design soil and water conservation structures.
2. Acquire knowledge and hands-on competence related to various aspects of soil and water conservation.
3. Demonstrate creativeness in designing new systems, components and processes in the field of engineering in general and agricultural engineering in particular.
4. Identify, analyse, and solve engineering problems useful to the society.
5. Work effectively with engineering and science teams as well as with multidisciplinary designs.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Crop Process, Drying and Storage Engineering**	Code:	**394453 (94)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**Ten (Minimum)**
Class Tests:	**Two (Minimum)**	Assignments:	**2 (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks:80**	**Minimum Marks: 28**

Course Objectives:

- To be familiar with agricultural crop processing and preservation
- To learn methods of mixing and screening
- To learn about crop drying and moisture control processes
- To learn about methods of storage and causes of spoilage

UNIT I:	Scope and importance of food processing, post harvest losses, principles and methods of food processing.Processing of farm crops; cereals, pulses, oil seeds, fruits and vegetables and their products for food and feed. Processing of animal products, minimal processing, Principle of size reduction, grain shape, size reduction machines; crushers, grinders, cutting machines etc. – operation, efficiency and power requirement – Rittinger's , Kick's and Bond's equation, fineness modulus.
UNIT II:	Theory of mixing, types of mixtures for dry and paste materials, rate of mixing and power requirement, mixing index. Theory of separation, size and unsized separation, types of separators, size of screens, sieve analysis, capacity and effectiveness of screens, pneumatic separation.
UNIT III:	Microwave and Dielectric heating. Extrusion processing, Scope & importance of material handling devices, study of different types of material handling systems; belt, chain and screw conveyor, bucket elevator, pneumatic conveying, gravity conveyor- design consideration, capacity and power requirement.
UNIT IV:	Moisture content and methods for determination, importance of EMC and methods of its determination, EMC curve and EMC model, principle of drying, theory of diffusion, mechanism of drying-falling rate, constant rate, thin layer, deep bed and their analysis, critical moisture content, drying models, calculation of drying air temperature and air flow rate, air pressure within the grain bed, Shred's and Hukill's curve, different methods of drying including puff drying, foam mat drying, freeze drying, etc. Study of different types of dryers- performance, energy utilization pattern and efficiency, study of drying and dehydration of agricultural products.
UNIT V:	Types and causes of spoilage in storage, conditions for storage of perishable products, functional requirements of storage, control of temperature and relative humidities inside storage, calculation of refrigeration load; modified atmospheric storage and control of its environment, air movement inside the storage, storage of grains: destructive agents, respiration of grains, moisture and temperature changes in stored grains; conditioning of environment inside storage through different methods, warehouse- design and control of environment. Storage condition for various fruits and vegetables under cold and CA storage system.Economic, aspects of storage.

Text books:

1. Carl. W.Hall. (1980).Crop drying.AVI Publishing Co. Inc.
2. Chakravarty, A. (1995). Post Harvest technology of Cereals, Pulses and Oil Seeds. Oxford and IBH Pub.Co. Calcutta.

Reference books:

1. 1. Multon, J.L. (1989). Preservation and Storage of Grains, Seeds and their By-Products: Cereals, oil Seeds, Pulses and Animal Feed. CBS Publishing and Distributions, Delhi
2. 2.Ooraikul, B and Stiles, M.E. (1992).Modified atmosphere Packaging of Food. Ellis HorwoodPublication,New York.

Course Outcome:

After studying the contents of the syllabus in detail the students will be able to

1. Practically Apply the knowledge to design processes and systems for Crop Process, Drying and Storage
2. Acquire knowledge and hands-on competence related to various aspects of Crop Process, Drying and Storage.
3. Demonstrate creativeness in designing new systems, components and processes in the field of engineering in general and agricultural engineering in particular.
4. Identify, analyse, and solve engineering problems useful to the society.
5. Work effectively with engineering and science teams as well as with multidisciplinary designs.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Engineering Thermodynamics**	Code:	**394454 (37)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**Ten (Minimum)**
Class Tests:	**Two (Minimum)**	Assignments:	**2 (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks:80**	**Minimum Marks: 28**

Course Objectives:

- To understand the applications of engineering thermodynamics in real life situations
- To perform gas power cycle analysis
- To analyze reciprocating air compressors
- To perform vapour power cycle analysis
- To analyze steam condenser, cooling pond and cooling towers.
- To analyze thermodynamic system with compressible fluid.

UNIT- I	**Second law of thermodynamics:** Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, PMM of Second kind, reversibility and irreversibility, causes of irreversibility, Carnot cycle, Carnot theorem, Absolute thermodynamic temperature scale.
UNIT-II	**Entropy:** Clasius theorem, the property of entropy, the inequality of Clausius, Entropy principle and its applications, Entropy change during different thermodynamic processes.
UNIT- III	**a) Equation of state:** Ideal gas equation of state, deviation of Real gas from ideal gas, van der waal's equation of state, correction for the intermolecular attractions, correction for finite size of molecules, evaluation of constants a and b, virial expansions, limitations of the van der Wall's equation, Reduced coordinates, compressibility factor, the law of corresponding states as per van der Wall's principle. **b) Mixture of perfect gases:** Mass Fraction, Mole fraction , Dalton's Law of additive pressure, Amagat-Leduc of additive volumes , Properties of mixture of ideal non reactive gases –gas constant, molecular weight, specific heat, internal energy, enthalpy and entropy.
UNIT-IV	**Properties of Pure substances:** Thermodynamic properties of pure substances in solid, liquid and vapour phases, Phase Transformations, dryness fraction, Triple point, critical state, p-v, p-T, T-s, h-s diagrams, P-V-T surfaces,– Properties and processes in ideal vapour, use of steam tables and Mollier's diagram in determination of steam properties, energy interaction and entropy calculations.
UNIT-V	**Boilers:** Classification of boiler, difference between water tube and fire tube boiler, construction and working of Cochran fire tube boiler, construction and working of Babcock Wilcox water tube boiler, High pressure boiler- advantages, construction and working of Lamont boiler, function of various boiler mounting and accessories, Draught-definition and classification. Performance of Boiler**:** Evaporation rate, equivalent evaporation, factor of evaporation, Boiler efficiency, Boiler trial, heat balance sheet of boiler. Studies based on Agriculture Engineering Applications.

Text Books:

1. Thermodynamics- An Engineering Approach – Cengal & Boles – McGraw Hill, Delhi
2. Engineering Thermodynamics – P.K. Nag – TMH Publishers

Reference Books:

1. Fundamental of engineering thermodynamics- R.Yadav ,CPH, Allahabad
2. Thermal Science & Engineering – D.S. Kumar – S.K. Kataria & Sons
3. Fundamental of Thermodynamic- Claus Borgnakke, Richard E. Sonntag, Wiley,Delhi
4. An Introduction to Thermodynamics-Y.V.C.Rao ,University Prass, Hyderabad
5. Thermodynamics & Thermal Engineering – J. Selwin Rajadurai – New Age International Publishers
6. Thermodynamics – C.P. Arora – TMH , Delhi
7. Thermodynamics – S.C. Gupta – Pearson Education,Delhi

Course Outcome:

After studying the contents of the syllabus in detail the students will be able to

1. Apply knowledge of classical thermodynamics for formulating and solving engineering problems.
2. Acquire knowledge and hands-on competence in applying the concepts of thermal sciences in the design and development of mechanical systems.
3. Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and agricultural engineering in particular.
4. Identify, analysis, and solve mechanical engineering problems useful to the society.
5. Work effectively with engineering and science teams as well as with multidisciplinary designs.
6. Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Numerical Analysis & Computer Programming (C & C++)**	Code:	**394455 (37)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**Ten (Minimum)**
Class Tests:	**Two (Minimum)**	Assignments:	**2 (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks:80**	**Minimum Marks: 28**

Course Objectives:

- To learn about existence and uniqueness criteria for numerical methods
- To learn about convergences criteria and to be aware of reasons why numerical methods may fail.
- Find numerical approximations to the roots of an equation by Newton method, Bisection Method, Secant Method, etc.
- Find numerical solution to a system of linear equations by Gaussian Elimination and Gauss-Siedel Iterative
- Find numerical solution for Curve fitting
- Find numerical solution for ordinary differential equation.
- Find numerical solution for Partial differential equation.
- To understand the basics of computer programming

UNIT- I	**Approximation and Errors in Computation:** Approximation and round of errors, truncation errors and Taylor Series, Determination of roots of polynomials and transcendental equations Bisection, Regula-falsi, Secant and Newton-Raphson methods, Solution of Linear simultaneous, linear algebraic equations by Gauss Elimination Gauss-Jordan and Gauss-Siedel iteration method.
UNIT-II	**Empirical laws, Curve Fitting & Interpolation:** Curve fitting linear and non-linear regression analysis (Method of group average and Least squares) Finite differences, Backward, forward and central difference relation and their use in Numerical differentiation and integration and their application in interpolation.
UNIT- III	**Numerical Solution of Ordinary Differential Equations:** Numerical integration by Trapezoidal rule, Simpson's (1/3rd & 3/8th) rule. Application of difference relations in the solution of partial differential equations. Numerical solution of ordinary differential equations by Taylor's series, Euler, Modified Euler, Runge-Kutta and Predictor-Corrector method.
UNIT-IV	**Numerical Solutions of Partial Differential Equations:** Introduction and application, Classification of second order equations, Finite differenceapproximations to partial derivatives, Elliptic equations, solution of Laplace equation, Solution of Poisson's equation, Solution of elliptic equations by relaxation method, Solution of one-dimensional heat equation.
UNIT-V	**Computer Programming:** I/O statement, Mathematical, Relational & Conditional Statements & Expressions. Switch Loops and Control Statements. Introduction to one dimensional arrays and two dimensional arrays.Studies based on Agriculture Engineering Applications.

Text Books:

1. Numerical Methods in Engineering & Science – Dr. B.S. Grewal – Khanna Publishers, 6th Edn. 2004
2. Numerical Methods – P. Kandasamy, K. Thilagavathy & K. Gunavathy – S. Chand & Co., 2nd Rev. Edn. – 2003

Reference Books:

1. Let us C – Yashwant Kanitkar, 5th Edn. – BPB Publihsers – New Delhi. 2004
2. Introductory Methods of Numerical Analysis – S.S. Sastry, 3rd Edn. – PHI – New Delhi, 2003
3. Numerical Mathematical Analysis – James B. Scarborough, 6th Edn. – Oxford & IBH Publishing Co. – New Delhi
4. Theory & Problems in Numerical Methods – T. Veerarajan, T. Ramchandran – TMH, New Delhi, 2004
5. Numerical Methods for Engineers – Steven C. Chapra, Raymond P. Canale, 4th Edn. – TMH, New Delhi
6. The Spirit of C – Henry Mullish & Herbert L. Cooper - Jaico Pub. House

Course Outcome:

After studying the contents of the syllabus in detail the students will be able to

1. Apply knowledge of numerical analysis for understanding, formulating and solving engineering problems.
2. Acquire knowledge and hands-on competence in applying the concepts of Numerical Analysis and Computer Programming in the
3. analysis of agricultural systems.
4. Identify, analysis, and solve mechanical engineering problems useful to the society.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Soil Mechanics**	Code:	**394456 (20)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**Ten (Minimum)**
Class Tests:	**Two (Minimum)**	Assignments:	**2 (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks:80**	**Minimum Marks: 28**

Course Objectives:

- To provide basic knowledge about Geotechnical Engineering, soil formation, index properties of soil, physical and engineeringproperties of soil.
- To know about the types of soil according their classification, classification system, field identification, study of effective stress,capillary seepage force, etc.
- How to measure the compaction and permeability of soil by lab experiments theoretically uses of Darcy law. Two dimensions flowand develop flow net and characteristics.
- To know about stresses due to applied load a soil mass, consolidation and their factor one dimensional consolidation as per Terzaghi theory
- To find shear strength in soil with the help of Mohr circle. How shear strength can be determine in laboratory, soil exploration.

UNIT I:	**Introduction:** Introduction to Geotechnical Engineering; Unique nature of soil; Soil formation and soil types, inter relationship of soil, soil mechanics and geotechnical engineering, aim and scope of soil mechanics. Index Properties of Soil Basic definitions; phase relations; physical and engineering properties of soil, soil grain and properties coarse and fine grained soils, Stoke's law, method of fine grained analysis.
UNIT II:	**Soil Classification and Effective Stress:** Indian standard soil classification system, Purpose of soil Classification, Different System of soil Classification, Field Identification, Principal of Effective Stress and Related Phenomena, Types of soil moisture, principal of effective stress; capillarity; seepage force and quicksand condition;
UNIT III:	**Compaction, Permeability and Seepage Analysis of Soil:** Clay mineralogy, soil structure, compaction theory, laboratory compaction tests, method of compaction control, permeability, one dimensional flow, permeability of soil, Darcy's law, laboratory methods of determination, pumping out tests for field determination of permeability, seepage through soils, two-dimension flow problems, confined flow and unconfined flow, flow net and their characteristics, exit gradient and failure due to piping, criteria for design of filters.
UNIT IV:	**Stresses due to Applied Loads and Consolidation:** Stresses due to applied Loads, Boussinesq equation of vertical pressure under concentrated loads, rectangularly loaded area, circular Loaded Area Newmart's Chart, Westergaard's equation, compressibility, effects of soil type, stress history and effective stress on compressibility, consolidation, factors affecting consolidation and compressibility parameters. Normally consolidated and over consolidated soils, different forms of primary consolidation equation – transient flow condition, Terzaghi theory of one-dimensional consolidation and time rate of consolidation.
UNIT V:	**Shear Strength and Soil Exploration:** Introduction, stress at a point and Mohr's stress circle; Mohr- Columb Failure criterion: Laboratory tests for shear strength determination; shear strength parameters; UU, CU and CD tests and their relevance to field problems; Shear strength characteristics of normally consolidated and reconsolidated clays; Shear strength Characteristics of sands, Soil Exploration, Various Method of field Exploration, Undisturbed Soil Sampling equipments and Field test (Static and Dynamic Penetration Test, PLT), cyclic plate load test and modern electronic test of site characterization.

Text Books:

1. Soil Mechanics and Foundations – B.C. Punmia, A. K. Jain, A. K. Jain (Laxmi Publication)
2. Soil Engineering in Theory and Practice (Vol-II) – Alam Singh (Asia Publishing House)

Reference Books:

1. Soil Mechanics and Foundation Engineering – S.N. Murthy (DhanpatRai Publications)
2. Basic and Applied Soil Mechanics – GopalRanjan and Rao A.S.R. (New Age International)
3. Design Aids in Soil Mechanics and Foundation Engineering – S.R. Kaniraj (Tata McGraw Hill)
4. Geotechnical Engineering Principles and Practice – D. P. Coduto (Prentice Hall of India)
5. Soil Mechanics and Foundation Engineering – Garg S.K. (Khanna Publishers)
6. Soil Mechanics and Foundation Engineering – Purushothama Raj (Pearson Education)
7. Text Book of Geotechnical Engineering – I. H. Khan (PHI Learning)
8. Foundation Engineering – R. B. Peck, W. E. Hanson, and T. H. Thornburn (John Wiley)
9. Foundation Design and Construction – M. J. Tomlinson (Pearson Education)

Course Outcome:

After studying the contents of the syllabus in detail the students will be able to

1. Apply knowledge of soil mechanics for various civil structure designs.
2. Acquire knowledge and hands-on competence in applying the concepts of soil mechanics in the design and development of mechanical systems.
3. Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and agricultural engineering in particular.
4. Identify, analysis, and solve mechanical engineering problems useful to the society.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Soil Mechanics Lab**	Code:	**394461 (20)**
Total Lab Periods:	**24**	Batch Size	**30**
Maximum Marks	**40**	Minimum	**20**

List of Experiments: *(At least Ten experiments are to be performed by each student)*

1. Determination of water content and specific gravity of soil.
2. Determination of field density of soil by core cutter and sand replacement method.
3. Grain size analysis-sieving (Dry sieve analysis) and hydrometer method.
4. Determination of liquid limit by Casagrand'e method.
5. Determination of liquid limit by cone penetrometer and plastic limit.
6. Determination of shrinkage limit.
7. Determination of permeability by constant head and variable head method.
8. Determination of compaction properties by standard proctor test.
9. Determination of shear parameters by Direct shear test.
10. Determination of unconfined compressive strength of soil.
11. Determination of shear parameters by Triaxial test.
12. Determination of consolidation properties of soils.
13. Verification of Bernoulli's theorem.
14. Determination of coefficient of discharge of venturimeter and orifice meter.
15. Determination of coefficient of friction in pipeline.
16. Determination of coefficient of discharge for rectangular and triangular notch.
17. Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice.
18. Measurement of force exerted by water-jets on flat and hemispherical vanes.
19. Determination of metacentric height.
20. Determination of efficiency of hydraulic ram.
21. Performance evaluation of Pelton and Francis turbine.
22. Velocity distribution in open channels and determination of Manning's coefficient of rugosity.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Agricultural Topography & Land Measurement Lab**	Code:	**394462 (94)**
Total Lab Periods:	**24**	Batch Size	**30**
Maximum Marks	**40**	Minimum	**20**

List of Experiments: *(At leastTen experiments are to be performed by each student)*

1. Chain survey of an area & preparation of map.
2 Compass survey of an area & plotting of compass survey
3. To determine the elevation of a point with respect to reference elevation by Fly Leveling
4. Contouring and its plotting.
5 Measurement of horizontal angle by repetition method.
6 Measurement of horizontal angle by reiteration method.
7 To determine the height of object when base is accessible
8 To determine the height of tower when base is inaccessible and instrument stations are in same vertical plane.
9 To find out the position of points by the Plane Table Radiation and Intersection method.
10 Determination of location of a point with the help of Two point problem.
11 Determination of location of a point with the help of Three point problem.
12 Setting out of curve by ordinates or offsets from long chord
13 Setting out of curve by successive bisection of arcs.
14 Setting out of curve by offsets from chords produced .
15 Setting out of curve by two theodolite method.
16 Setting out of curve by Rankine's method.

Equipment/Machines/Instruments/Tools/Software Required:

- Metric Chain (30 m)
- Tape (15m, 30 m)
- Ranging Rod (2 m, 3m)
- Plumb bob
- Arrows
- Theodolite
- Leveling Staff (Folding and Non-folding)
- Wooden Pegs
- Plain Table Accessories (Drawing Board – 70 x 60 x 1.5 cm, Spirit Level, Trough Compass, Tripod Stand, Alidade,
- Plumb bob for centering)
- Offset Rod
- Optical Square
- Cross Staff

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Crop process and drying and storage engineering lab**	Code:	**394463 (94)**
Total Lab Periods:	**24**	Batch Size	**30**
Maximum Marks	**40**	Minimum	**20**

List of Experiments: *(At leastTen experiments are to be performed by each student)*

1. Preparation of flow and layout charts of a food processing plant.
2. Determination of fineness modulus and uniformity index.
3. Performance evaluation of hammer mill.
4. Performance evaluation of attrition mill.
5. Study of cleaning equipment.
6. Separation behavior in pneumatic separation.
7. Study of grading equipment.
8. Evaluation of performance of indented cylinder separator.
9. Performance evaluation of screen pre-cleaner.
10. Determination of mixing index and study of mixers.
11. Study of conveying equipments.
12. Performance evaluation of belt conveyor.
13. Performance evaluation of bucket elevator.
14. Performance evaluation of screw conveyor.
15. Study of mechanics of bulk solids affecting cleaning.
16. Study of mechanics of drying of grains.
17. Measurement of moisture content during drying and aeration.
18. Measurement of relative humidity during drying and aeration using different techniques.
19. Measurement of air velocity during drying and aeration.
20. Problems using psychometric chart.
21. Drying characteristic and determination of drying constant.
22. Determination of EMC and ERH.
23. Study of various types of dryers.
24. Design of dryers.

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Name of Program:	**Bachelor of Engineering**		
Branch:	**Agricultural Engineering**	Semester:	**IV**
Subject:	**Numerical Analysis and computer programming Lab (C and C++)**	Code:	**394464 (37)**
Total Lab Periods:	**24**	Batch Size	**30**
Maximum Marks	**40**	Minimum	**20**

List of Experiments:

1. Write a program to calculate the area & perimeter of the rectangle and the area & circumference of the circle. The length and breadth of a rectangle and radius of a circle are input through keyboard.
2. Write a program to determine whether the character entered through a keyboard is a capital letter, a small case letter, a digit or a special symbol.
3. Write a program which has the following options:
    a. Factorial of a number
    b. Prime or not
    c. Odd or even
4. Write a program to implement Bubble sort on a set of 10 numbers.
5. Write a program to store every character typed at the keyboard into a file. The procedure should come to an end as soon as the 'Esc' key is pressed.
6. Write a program to find the roots of an equation using Newton Raphson Method.
7. Write a program to practice one of the Numerical Integration Method.
8. Write a program to find the solution of Differential Equation by Modified Euler's Equation.
9. Write a program to find the solution of Differential Equation by Runge Kutta Equation.

List of Equipment/Instruments/Machines/Software Required:

1. Hardwere Required: P-IV, 2.6 G. Hz., 128/256 MB SDRAM, 40 GB HDD, 14" Colour Monitor, 52 X CD RW, Laser Scroll Mouse
2. Software Required: C & C++