

Course Structure

B-Tech Water Resource Engineering

Applicable from 2009 Batch

SEMESTER – I

S. No.	Course Code	Course Title	L- T- P	Credits
1.	GPT 301	Moral & Value Education	2- 0 -0	2
2.	MAS 312	Elementary Mathematics (Ag group)	3- 0- 0	3
3.	AGRN 403	Principles of Agriculture (PCM Group)	2- 0- 1	3
4.	PHY 312	Engineering Physics	3- 1- 1	5
5.	ME 304	Workshop Practice	2- 0- 2	4
6.	ME 301	Engineering Graphics -I	0- 0- 2	2
7.	EEE 301	Basic Electrical Engineering	3- 0- 1	4
8.	SES 402	Soil and Water Chemistry	2- 0- 1	3
9.	ECE 301	Basic Electronics	2- 1- 1	4

SEMESTER II

1.	LNG 304	Professional Communication & Technical Writing	2-0- 1	3
2.	SES 503	Soil Physics	2- 0- 1	3
3.	MAS 411	Engineering Mathematics –I	3- 1- 0	4
4.	ME 408	Engineering Thermodynamics	2- 0- 1	3
5.	ME 401	Engineering Graphics –II	0- 0- 2	2
6.	COMP 410	Computer & Languages	2- 1- 1	4
7.	CE 401	Engineering Mechanics	3- 0- 0	3
8.	BAM 213	Principle of Management	2- 1- 0	3

SEMESTER – III

1.	MAS 490	Engineering Mathematics –II	3-1-0	4
2.	CE 406	Fluid Mechanics	3-0-1	4
3.	CE 411	Foundation Engineering	2-0-0	2
4.	SWLE 405	Introduction to Water Resource Engineering	3-0-0	3
5.	CE 408	Strength of Materials	2-1-0	3
6.	CE 402	Surveying & Leveling	2-0-2	4
7.	CE 410	Soil Mechanics	2-1-0	3
8.	AET 401	Agricultural Engineering - I	3-0-1	4

SEMESTER – IV

1.	SWLE 501	Soil & Water Conservation Engineering	2-0-1	3
2.	AET 402	Agricultural Engineering - II	3-0-1	4
3.	MAS 551	Numerical Analysis	4-0-0	4
4.	SWLE 403	Engineering Hydrology	3-0-0	3
5.	MAS 511	Statistical Methods	2-0-1	3
6.	MAS 512	Operation Research	2-1-0	3
7.	SES 415	Environmental Studies-I	2-0-0	2

8.	CE	409	Building Materials and structural design	2-1-0	3
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SEMESTER - V

1.	SWLE 406	Water Resource System Planning	3-0-0	3
2.	SWLE 407	River Engineering & Flood Water Control	3-1-0	4
3.	SWLE 408	Environmental Engineering	3-0-0	3
4.	SWLE 502	Irrigation Engineering	3-0-1	4
5.	SWLE 505	Drainage Engineering	2-0-1	3
6.	SWLE 506	Design of Water Resource Structures –I	2-1-0	3
7.	SWLE 513	Water Lifting Machines	3-0-0	3
8..	SES 416	Environmental Studies-II	2-0-0	2
9.	AET 400	Training – I	0-0-1	1

SEMESTER - VI

1.	SWLE 507	Design of Water Resource Structure – II	2-1-0	3
2.	SWLE 508	Ground Water Engineering	3-0-0	3
3.	SWLE 509	Erosion and Sedimentation in Streams and Reservoirs	3-0-0	3
4.	SWLE 510	Water Resource System Analysis	3-0-0	3
5.	SWLE 515	Rural and Urban Water Supply	2-1-0	3
6	SWLE 601	Integrated Watershed Management	2-0-1	3
7.	SWLE 514	Open Channel Flow	2-1-0	3
8	SWLE 609	Water Power Engineering	3-0-0	3

SEMESTER - VII

1.	SWLE 608	Waste Water Engineering	3-0-0	3
2.	SWLE 611	Water Quality Management	2-0-1	3
3.	SWLE 512	Waste Land Management	3-0-0	3
4.	SWLE 602	Water Harvesting and Ground Water Recharge	3-0-0	3
5.	SWLE 603	Operation, Maintenance and Economic Evaluation of Water Resource Projects	3-0-0	3
6.	SWLE 607	GIS and Remote Sensing	2-0-1	3
7.	SWLE 503	Hydraulics & Design of Irrigation Systems	3-0-0	3
8.	AET 500	Training –II	0-0-1	1
9.	AET 580	Seminar –I	0-0-1	1
10.	AET 699 a	Project (Project Formulation)	0-0-2	2

SEMESTER - VIII

1.	SWLE 605	Water Laws & Policies	3-0-0	3
2.	SWLE 606	Minor Irrigation	2-0-1	3
3.	SWLE 610	Landscape Irrigation Design and Management	3-0-0	3
4.	AET 680	Seminar –II	0-0-1	1
5.	AET 699 b	Project (Project Execution and Report)	0-0-7	7

Detail Course Syllabus

B-Tech Water Resource Engineering

SEMESTER – I

GPT 301

Moral & Value Education

2 (2-0-0)

My country and my people, the many Indians, being and becoming an Indian, Nationalism and Internationalism.

Some life issues – Love, Sex and marriage, Men and Money - value of time, meaning of work, human communication, human suffering, addiction, ecology, women's issues.

Understanding one's neighbor, neighbor hood groups: their structure and functions, patterns of social interaction of group dynamics.

Preparation for career, choice of vocation, motivation for study and research, the present education system: curriculum and syllabus, teaching method, examination and work experience.

Definition of value education, Moral and Ethics, Laws and Moral based on Ten Commandments and two great commandments.

Discovery of self, Self-awareness, Growth of intellect- Man's spiritual nature, emotions, will. Respect the rights of life , liberty, property , truth reputation.

Sin, Origin of sin, manifestation of sin, the results of sin, the remedy of sin, sin as an act, sin as a state, sin as a nature.

Conscience – as defined in Oxford dictionary and Winston Dictionary, types of consciousness (such as evil, convicted, purged, pure, weak, good, void of offence).

MAS 312

Elementary Mathematics (Ag Group)

3 (3-0-0)

Algebra:

Theory of quadratic equations i.e. ($ax^2 + bx + c = 0$), Binomial theorem (for positive integral index only). Uses of Natural and Common Logarithms, Exponential series, Partial Fractions, Determinants (of order three only), Theory of Matrices (Addition, Subtraction), Product of Matrices, Transpose, Elementary idea of following: adjoint, Inverse of matrices by adjoint method, Solution of liner equations, Solution of inequalities, Permutation and combination.

Trigonometry:

Trigonometry functions, addition and subtraction formula, Double and half angle formula, Laws of sines and cosines, Solution of triangles, Height and distances, Real and complex numbers, Hyperbolic trigonometric functions, De Moivre's theorem.

Coordinate Geometry:

Distance between two points, Area of triangles, Straight lines (Parallel and at right angles)

Calculus: Elementary Differentiation and Integration.

AGRN 403

Principles of Agriculture (PCM) group

3 (2-0-1)

Crop Classification, Cropping systems for major agro-ecological regions; crop ecosystem and strategies of crop production in tropical and sub-tropical regions; modern techniques of raising field and horticultural crops; tillage practices and soil management, seeds and seeding practices; scheduling of irrigation and fertilizers; plant protection measures; harvest and post harvest operations; dry land farming principles and practices; crop growth assessment and modeling.

Practical: identification of an acquaintance with seeds, plants, weeds and Agro – chemicals, testing of Germination, viability and vigour of seeds, estimation of agro-chemicals for field application, determination of tillage requirement for field preparations, Hydroponics, seeding and planting techniques and assessment of stand and establishment of field crops, Irrigation water measurement techniques, Biometrics observations of growth, yield and yield attributes, measurement of Leaf Area index, Determination of chlorophyll content in leaf, estimation of oil in different oil seed crops, Determination of N,P,K, in crops, testing quality of Crops

PHY 312

Engineering Physics

5 (3-1-1)

Surface tension: Angle of contact, Excess of pressure inside a spherical surface, Capillary rise, Determination of surface tension by Jaeger's methods.

Viscosity: Streamline and turbulent motion, Coefficient of viscosity, Critical velocity, Poiseuille's equation for flow of liquid through a tube, Viscometer.

Optics: Interference, Thin films, Testing of Optical plainness of surfaces. Young's double slit experiment – Coherent sources, Intensity in Young's experiments, Interference in thin films, Newton's ring and Michelson interferometer. Diffraction Fraunhofer diffraction at single slit, Diffraction at a circular aperture, Diffraction at double slit, Diffraction Gratings, Resolving and dispersive power of a grating.

Polarization: Production and detection of circularly & elliptically polarized light. Quarter and half wave plates, Optical activity, Specific rotation, Lurent's half shade polarimeter, Determination of specific rotation and strength of sugar solution. Ultra Sonics: Production, application in ranging, Cleaning and drilling.

Practical: Production and measurements of vacuum. Mechanical pumps (Rotary vacuum pump) Diffusion and condensation pumps, Gettesr measurement : Manometer, Mecleod gauge, Piram gauge. Measurement of temperature: Thermo e.m.f., Measurement of thermo e.m.f. by potentiometer, Higher temperature measurement by using pyrometers and resistance thermometer.

ME 304

Workshop Practice

4 (2-0-2)

General: Workshop terminology, ferrous and non ferrous metals, steel and alloy steels, light alloys and non ferrous heavy metals, heat treatment, case hardening, corrossions, Plastics, glue, grease, paint, varnish and lacquers.

Carpentry: Timber classification, defects in timber, description and use of tools in carpentry.

Smithy: Nature of work in smith's furnace tools and their uses, safety and precautions in smithy, jigs and fixtures, hot and cold working of metals, forging drawing and spinning

Fitting: Description and use of files, chisels, hacksaw, vices, hammers and other measuring marking tools, precision measuring tools, dial gauges and inspection gauges.

Machine Job: Classification and description of lathe machine, milling, drilling and grinding machine, special purpose machines- Turret and Capstan –Lathes, gear cutting machines.

Welding Job: Types of welding oxyacetylene gas welding, electric arc welding, argon arc welding, MIG and TIG welding, resistance welding, brazing and soldering, use of fluxes.

Sheet metal shop- Description and uses of tools used in sheet metal shops, different joints, riveting, Sawing and simple joints, planing; Chipping marking and filing; Knurling, centering, drilling and threading, etc.; Forging operation; Welding joint preparation; Metal arc welding and gas welding practice; Revetting operation for lap joint.

ME 301

Engineering Graphics – I

2 (0-0-2)

Construction and use of scales, Lettering, Construction of plane geometrical figures, parabola, hyperbola and ellipse, Special plane curves, Epicycloids, Hypocycloid, Involute and spirals, Helix and simple loci. Orthographic projection of points, Lines their traces and inclination. Projection of solids like prism, Cylinder, Cone, Pyramid and development of surface. Introduction to CAD. Construction of isometric scales, Isometric projection of simple objects.

EEE 301

Basic Electrical Engineering

4 (3-0-1)

Kirchhoff's laws, delta star and star delta transformation, Thevenin's and super position theorem, A.C fundamentals, average and effective values in signals, transient and steady state response of circuit, active and reactive power, resonance in circuits, filters, analysis of three phase circuits, characteristics of magnetic and dielectric materials, magnetic circuit, hysteresis and eddy current losses, two port network parameters, force acting on current carrying conductor in magnetic field, magnetic force due to electric current, statically and dynamically induce EMF, stored energy, force between parallel conductors, single phase transformer, construction principle EMF equation, transformer efficiency.

Practical: Verification Kirchhoff's laws, measurement of current voltage, frequency and power, determination of impedance and its components, three phase power measurements, electromagnetic relays and solenoids, calibration of energy meter and watt meter, no loads and open circuit test of a transformer, efficiency of the transformer, circuits phasor diagrams of single phase circuits, relation between line and phase voltage and currents.

SES 402

Soil and Water Chemistry

3 (2-0-1)

Chemical nature of the mineral and organic constituents of soil and of the solution; Ion exchange and soil other colloidal phenomena including the effect of soil amendments and fertilizers; Microbiological process in soils. Quality of irrigation water ; chemistry of water ; Quality of water; Analysis of Water.

ECE 301

Basic Electronics

4 (2-1-1)

Introduction to signals, spectra, transducers, electronics and systems, p-n junction diodes, rectifiers – half-wave, full wave, capacitive filters, Zener diodes, power supply and voltage regulation; p-n-p and n-p-n transistors, transistor characteristics, transistor as an amplifier – CE, CB, CC; biasing and bias-stability, small-signal, equivalent Circuits, H-Parameter Model, Signal Handling Capacity, Frequency Response Of Amplifiers; Concepts Of Feedback Amplifiers, negative feedback, gain-bandwidth product, regenerative feedback and conditions for oscillation, oscillators; OP-AMPs and application of OP-AMPs; Field effect devices – JEFT, MOSFET and their characteristics; SCRs, power amplifiers; Logic Gates; Flip – Flops and ICS.

SEMESTER – II

LNG 304 Professional Communication & Technical Writing 3 (2-0-1)

Reading Comprehension- Factual- formulating translating global comprehension – language- in – use in terms of synonyms, collection in context, introduction to different types of writing – descriptive – narrative and exposition letter - writing-formal and informal – speech acts-norms of preparing introductory address, presidential address, vote of thanks.

Integrated grammar by means of class exercise, common errors in English writing – use of cohesive devices – dialogue practice – orientation to different types of letters - performing different speech acts according to contexts – exercise based on examination like TOEFL, GRE and GAT.

SES 503 Soil Physics 3 (2-0-1)

General physical characteristics of salt, soil as a dispersed three phase system, volume and mass relationships of soil constituents, soil profile, texture, particle size distribution, specific surface and soil classes, nature and behavior of clay, soil structure of aggravation, soil water content and potential, measurements of soil water, flow water in saturated and unsaturated soils, soil air and aeration, soil temperature and heat flow, soil compaction and consolidation.

Practical: Measurement of soil physical characteristics, soil water content, soil water potential, soil moisture characteristic curve, infiltration, hydraulic conductivity and soil composition.

MAS 411 Engg. Mathematics – I 4 (3-1-0)

Differential Calculus: Asymptotes- curves and curvature partial differentiation-Euler's theorem, total differential coefficient. Taylor's theorem for two variables, maxima and minima Lagrange's multiplier.

Integral Calculus: Application of integral calculus area enclosed by curves length of arc. Volume and surface of revolution, Evolution of double and triple integrals, Gamma and Beta functions- Dirichlets' s integral. Simple tests of convergence of integrals.

Infinite Series :Convergence and divergence of series, tests of convergence, Alternating

Fanning's equations, Moody's diagram, energy losses through pipe fittings, flow through network of pipes.

Practical: Study of pressure measuring devices, Relationship between depth of liquid and pressure exerted by it, Determination of metacentric height of floating vessels, Determination of pressure drop flow rate relationship for flow of air through packed bed and fluidization velocity, Determination of flow pattern, port arrangement and pressure drop in a plate heat exchanger, Verification of Bernoulli's theorem, Demonstration of laminar and turbulent flows, Determination of head loss through pipes and pipe fittings. Determination of coefficient of discharge for a venturimeter, Determination of orifice meter coefficient, Calibration of a notch, Measurement of non-Newtonian parameters of liquid foods, Determination of forces on submerged bodies, Flow visualization using smoke in a transparent tube to demonstrate path line, streak line, laminar and turbulent flows, Experiments using water table to demonstrate various flow phenomena, Measurement of viscosity surface tension of liquids, Demonstration of momentum theorem using impulse and reaction turbines, Estimation and measurement of flow rate through single screw extruder.

CE 411

Foundation Engineering

2 (2-0-0)

UNIT – 1

Bearing capacity (Rankine analysis, Terzaghi analysis, effect of water table on bearing capacity, plate load test, penetration test.)

UNIT – 2

Shallow foundation (Types of foundation, spread footing, safe bearing pressure, settlement of footing, combined & strap footing, Mat & Raft footing.

UNIT – 3

Pile foundation (Types of piles, pile driving, Load carrying capacity of pile, dynamic formula, static formula, pile load test, penetration test, group action in pile, negative skin friction, laterally loaded pile, under reamed pile foundation & bored pile.

UNIT – 4

Well foundation (Introduction, caissons, shapes of wells & component part, depth of well foundation & bearing capacity, force acting on well foundation, well sinking, analysis of well foundation & pneumatic caisson

UNIT – 5

Machine foundation (Soil dynamics, the mass spring system, vibrating spring mass system with damping, force vibration, natural frequency of foundation, soil system, bulls of pressure concept

SWLE 405

Introduction to Water Resource Engineering

3 (3-0-0)

Origin of water and rain droughts area in India, Irrigation and water resource potential, Majors rivers in India, Assessment of flow in rivers in India, Classification of river basins, Domestic, Industrial and Agricultural water demands, Water demands for hydro power generation, Navigation and recreation, Types of Aquifers and wells, Ground water recharge, Assessment of ground water potential, Optimum utilization of water resources in irrigation, Water losses, Social –economic aspects & scope of water resource engineering.

CE 408

Strength of Materials

3 (2-1-0)

Concept of stress, normal and shearing stress in axially-loaded members, factors of safety and introduction to design the strength, concepts of strains, normal and shearing strains, stress- strain relationship, generalized Hooke's law, strain compatibility in two dimensions and application to isotropic materials, plane stress and plain strain; Poisson's ratio, stress –strain diagrams for uniaxial loading deformation of axially loaded members and statically indeterminate problems torsion's of circular shafts: stress and deflections in closed coiled and helical springs subjected to axial forces; members subjected to flexural loads; reactions for statically determinate beams; relationship between loads, shearing force and bending moment; shear force and bending stresses in beams; shearing stresses in beam; members subjected to combined loads; transformation of plain stresses and strain; principal stresses and principal plains; principal strains, Mohr's circle of stresses and strain , principal stresses in 3D; relationship between elastic constant; Strain rosettes; principal stresses for strain measurements; combine torsion and bending; investigation of stress at a point; pressure vessels; byaxial stresses; yield theories; principles of design for strength; deflections of beams; direct integration method, moment area method.

CE 402

Surveying & Leveling

4 (2-0-2)

Measurement of distance, principle and methods of chain surveying, prismatic compass and chain traversing, theodolite traversing, plane table surveying including two-point and three–point problems, leveling and contouring, measurement of areas and volumes, principles of hydrographic surveying and aerial surveying and their application to agricultural engineering.

Practical: Handling of chain and chain accessories, offsetting, acquaintance with field book; Ranging out surveying line and plotting chain survey; Triangulation by chain and offsetting for details for preparation of map of a small area; Plotting of the field book reading for preparation of map acquaintance with symbols of different objects used in maps and scale of map; Setting up of prismatic compass and measurements of angles; Traversing of a small area with chains and prismatic compass and offsetting for details; Plotting of the above map; Setting up off a 20'' accuracy transit Theodolite and measurement of horizontal angles and verticals angle; Setting up off a plain table and off setting by intersection method; Plain table traversing (5 sides); Setting up off a dumpy level and exercise in fly leveling and reciprocal leveling; demonstration of modern equipment- Theomat, Distomat and Automatic levels.

CE 410

Soil Mechanics

3 (2-1-0)

Engineering properties of Soil, Soil Hydraulic, Stress distribution, Compressibility, Shear strength, Earth Pressure, Rankine theory, Coulombs wedge theory, Stability of slopes, Stability analysis of finite & infantine slopes, Taylor's stability nos. and stability curves, Bishops methods of stability analysis.

Bearing Capacity: Rankines analysis, Terzaghis analysis, Effect of water table on bearing capacity, Shallow foundations; Types of foundation, spread footing, well foundation, shape of wells and components, Depth of well, foundation and bearing capacity, forces

acting on a well foundation, analysis of well foundation, well sinking, pile and machine foundation.

AET 401

Agricultural Engineering I

4 (3-0-1)

Status and scope of farm mechanization, Classification, constructional details, principles of operation of manually operated, animal drawn and power operated implements and machinery used in crop production viz. primary and secondary tillage implements, puddlers, intercultural implement, seeding, planting and fertilizer application equipment, plant protection equipment. Crop harvesting and threshing equipment, chaff cutters and sugarcane crushers. Hitching of implements. Safety in farm machinery. Performance evaluation, selection and cost analysis.

Practical: Practical study of primary tillage and secondary tillage implements. Constructional and functional study of different types of seed-drill, Calibration of seed drills. Study of sprayers & dusters, self-propelled rice transplanter, different types of power operated reapers and threshers.

SEMESTER – IV

SWLE 501

Soil & Water Conservation Engineering

3 (2-0-1)

Soil Erosion: Factors affecting and damages caused, Processes and types of erosion, Quantitative soil loss equation, Universal soil loss equation.

Soil Erosion Control Practices: Agronomical practices, Contouring, Crop rotation, Strip cropping, Vegetative control of gullies, Vegetated water ways, Mulching, Green manuring pastures and Agro-forestry.

Contour and Graded Bunds: Types, Layout, Design construction, Cost estimation and maintenance.

Bench Terraces: Types, Design construction, Layout, Cost estimation and maintenance, Land clearing, Leveling and grading

Gully Control Structures: Types of temporary & permanent gully control structures, Planning and design of soil bed earthen bunds, Wooden post and woven wire check dam, Loose rock fill dam, Drop spillway, Chute and drop inlet spillway.

Land Slides & Erosion Control on Hills: Stream bank erosion, Planing, Design & construction of vegetative & machinery spur, Coastal erosion control practices, wind erosion and its control practices.

Rain Water Harvesting & Storage Structures: Water harvesting techniques, Types of water harvesting structures, Planning, Design & maintenance of ponds and reservoir.

Field visit of problematic area and study of different types of erosion control structures & water harvesting structures.

Estimation of land shaping and grading for development, study of working of scraper, leveler and grader, operation of grader for leveling, study of working and operation of bulldozer, efficiency test of earth moving machineries, drainage and chemical treatment

of land, preparation of seed beds for rain fed farming, design, drawing and preparation of estimates for different soil conservation structures.

AET 402

Agricultural Engineering II

4 (3-0-1)

Threshing machines- design, principles, operations, maintenance and testing, winnovers, cleaners and graders & separators, Design principles, operation, maintenance and testing. Dehuskers, shellers, hullers, polishers, Grinders – Design Principles, operation, maintenance and testing. Drying of farm crops – principles of drying, EMC Drying curves, thin layer drying, fluidized bed drying, batch drying. Psychrometry-Properties of air & water vapour mixture. Dryers – Types, design principles, operation, maintenance and testing. Storage bins – design criteria, operation, maintenance, aeration and moisture migration in storage bins, detection and control of fungal and microbial insects and pests growth in the stored produce, storage technologies-control atmosphere storage, modified atmosphere storage, cover and plinth storage, hypobaric storage. Retail storage packaging – Nitrogen packaging, CO₂ packaging, vacuum packaging, retortable packaging.

Practical: Determination of moisture content of Farm produce by direct and indirect methods, Size reduction and determination of Bond's energy constant for grains, Determination of milling quality of paddy, Determination of milling quality of wheat, Sieve analysis of grain milling products, Parboiling of paddy, Performance of a thresher, cleaner and girder, Determination of shelling efficiency of a ricke dehusker, Performance of a rice polisher, Evaluation of thermal efficiency and heat utilization factor in a grain dryer, Performance of an oil expeller, Rice and flour mills layout, Frangraphy for dough development of wheat flour.

MAS 551

Numerical Analysis

4 (4-0-0)

Introduction:

Errors in Numerical computation; Mathematical preliminaries; Errors and their analysis; Machine computation; Computer software.

Algebraic & Transcendent Equation:

Bisection method; Iteration method; Method of false position; Rate of convergence; Method for complex root; Newton Raphson method.

Interpolation:

Introduction; Error in Polynomial Interpolation; Finite differences; Decision of errors, Newton's formula for Interpolation.

Curve Fitting, Cubic Spline & Approximation:

Introduction; Method of least square curve fitting procedures; Fitting a straight line; Numerical differentiation; Numerical Integration; Approximation of functions.

Numerical Integration & Differentiation:

Introduction; Numerical differentiation; Numerical Integration, Trapezoidal Rule; Simpson 1/3 Rule; Simpson 3/8 Rule.

Statistical Computation:

Frequency chart; Correlation; Regression analysis; Least square fit; Polynomial fit; Linear & non-linear regression, Multiple regression, Statistical quality control methods.

SWLE 403**Engineering Hydrology****3 (3-0-0)**

Weather and hydrology, Forms of precipitations; Measurements and estimations, Evaporation & transpiration: Factor affecting, Measurements and estimation, Stream flow measurement: Measurement of stage & velocity, Stage discharge relationship, Runoff: Introduction hydrograph, runoff characteristics of streams, yield (annual runoff volume), flow duration curve, flow mass curve. Hydrograph: Factors affecting flood hydrograph, Components of hydrograph, Base flow separation, Effecting rainfall, Unit hydrograph, Synthetic & Instantaneous unit hydrograph, Flood routing: Basic equations and Method of flood routing, Hydrologic channel routing, Clark method for instantaneous unit hydrograph, Nash conceptual model.

MAS 511**Statistical Method****3 (2-0-1)**

Statistic, population parameter, frequency distribution, frequency polygon, histogram, bar chart arithmetic, weighted, geometric and harmonic mean, mode, median for grouped and ungrouped data, standard deviation, mean deviation and coefficient of variation, simple and multiple correlation coefficient, regression line, fitting equations to data by least square method, curve linear regression line, fitting equation to data by least square method, curve linear regression. Test of significance; t, F and χ^2 tests. Distribution: Normal, Binomial and Poisson distribution, confidence interval. Analysis of variance; definition, assumption, one-way and two way classification with one per cell, probability theory.

MAS 512**Operation Research****3 (2-1-0)**

OR definitions; principle components of decision problems – scope in agricultural and food engineering; principles of modeling; linear programming – concepts, graphical and algebraic solution, simplex method, revised simplex method, duality theory, post-optimality analysis; transportation and assignment models; computer applications to LP, queuing theory; project scheduling and management by PERT – CPM, integer programming; non linear programming – Fibonacci and Golden Section Search; Lagrange Multipliers and Kuhn-Tucker Conditions; introduction to dynamic programming and simulation

SES 415**Environmental Studies -I****2 (2-0-0)**

Definition, Scope and Importance. Ecosystem, concept of an ecosystem, structure and function of an ecosystem, Producer, consumer and decomposes, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, Characteristic features, structures and function of the following ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem.

Social Issues and the Environment: from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problem and concerns, Case

studies. Environmental ethics, Climatic change, wasteland reclamation, consumerism and waste products. Environmental Protection Act. Air (Prevention and control of pollution) act. Issues involved in enforcement of environmental legislation. Public awareness.

Practical: Visit of different polluted sites to assess their effect on pollution, monitoring of pollutant in ecosystem. Study of simple ecosystem- ponds, rivers, hill slopes. Study of common plants, insects, (Herbarium file/ insect box) Visit of local polluted site-urban/rural/agricultural/ industrial. To study the different purification of industrial effluents and wastes.

CE 409 Building Materials & Structural Design 3 (2-1-0)

Steel and its structural properties, Riveted and welded connections, Design of sections for tensions, Compression and bending including built-up sections, Grillage foundations, Roof trusses, Plate and lattice girders, Industrial buildings, Indian standard code. Introduction to I.S. code for practice for R.C. design, Design of two- way slabs, Retaining walls, Continuous beams, Water tanks etc. IRC bridge loadings – load distribution on bridge girders.

Design of Masonry and Timber Structures. Working Stress Design Method: Assumption, distribution of stresses on the cross section in bending transformed area, analysis and design of rectangular singly and doubly reinforced section, T and L sections.

Limit State Design Method: Assumptions, distribution of stresses on the cross section in bending Analysis and design of a rectangular singly & doubly reinforced Sec., T and L Sections.

SEMESTER – V

SWLE 406 Water Resource System Planning 3 (3-0-0)

Introduction and concept of water resource planning, Problems in water resource planning, Objectives, Steps and phases of water resource planning, Project formulation and evaluation, Environmental consideration in water resource planning, Pitfalls in planning, Multipurpose water resource systems, Objectives and compatibility of multipurpose water resource system, Introduction and application of system analysis, Mathematical modeling and application of deterministic in water resource planning, Linear programming to different water resources problems. Economic analysis of water resource projects.

SWLE 407 River Engineering & Flood Water Control 4 (3-1-0)

River Engineering:

Introduction and classification of river, behavior of rivers, river region theory, mechanism of meanders development, types of alluvial river region, cut off, effects of dam on river region, conveyance of surface water through river intake and dam outlet.

Objectives and Principles of River Training:

Methods of river training, classification of river training works, design parameters of embankments, bank protection spurs and artificial cutoff, case study.

Flood Control:

Definition and causes of floods, flood forecasting techniques flood flows and then estimation, estimating design flood and flood flows, CWC recommended for choosing design flood and values for design of hydraulic structures, Different methods of flood control selection and estimation of design flood, flood control by reservoirs, operation problems of flood control reservoirs, Lavees and flood walls, diversion of flood water, watershed management for flood control, flood plain management, emergency evacuation, benefit of flood control, cost and benefit analysis of flood control, economics of flood control projects, National policy for flood control; Case study.

SWLE 408

Environmental Engineering

3 (3-0-0)

Environment and its component, Pollution of environment by human activity, introduction to water, air, land, thermal & noise pollution, introduction to environmental impact pollution, ecology and ecosystem, concept of ecology imbalances, elements of environmental analysis, introduction of water quality impact analysis, environmental legislation and environmental audit; Industrial process and waste treatment unit, sedimentation, design of primary and secondary sedimentation tank. Settling and removal efficiency for discrete and flocculent setting mechanics of coagulation, flocculation. Filtration; Suitability of sewage for irrigation, location and design of sewage farms, public health aspects of sewage farms, economic and social aspects of sewage irrigation. Disposal of sewage on land, techniques for environmentally sound water resource development.

SWLE 502

Irrigation Engineering

4 (3-0-1)

Source of irrigation water, measurement of irrigation water infiltration, application of soil plant atmospheric continuum and principles of fluid mechanics to design of irrigation system, water balance equation and evaluation of different components; measurement of evaporation and evapo transpiration; Estimation of irrigation water requirement and irrigation scheduling; efficiencies of irrigation systems, hydraulics, design and evaluation of surface, sub-surface, overhead and drip irrigation systems; design of water conveyance systems including control structures, design principles, characteristics curves, selection of pumps and prime movers.

Practicals: Determination of bulk density of soil, Determination of soil moisture stress at different depths by tensiometers, Aggregate analysis of soil, Determination of coefficient of permeability of soil by constant head method & variable head method, Determination of moisture content of soil by gravimetric method, Determination of infiltration characteristics of soil, Determination of coefficient of discharge of various V-notch and rectangular notches, Determination of advance and recession in check basin method of surface irrigation, Determination of uniformity coefficient of overhead and mini sprinklers, Determination of distribution uniformity of drip irrigation, Determination of head loss in irrigation pipes

SWLE 505**Drainage Engineering****3 (2-0-1)**

Agricultural land drainage problems, drainage requirements of crops, drainage investigation for planning and execution of drainage systems; determination of drainage co-efficient and drainable porosity; drainage methods; principles, design, analysis and layout of surface drainage, horizontal, subsurface & vertical drainage system; equipment and machines for installing drainage systems; equipment and machines for installing drainage systems, reclamation of water logged and salt affected lands; water quality and pollution; planning of integrated irrigation and drainage system; drainage materials, their specification and comparative performance, field visits to drainage projects.

Practical: Installation of observation wells and piezometers, Preparation of isobaths and water table contour maps, installation of surface and subsurface drainage systems, field visits to drainage projects, economic evaluation of drainage system installation,

SWLE 506**Design of Water Resource Structures – I****3 (2-1-0)**

Planing, Layout and distribution system of canal network, Types of canals, Canal alignment, Estimation of head discharge and water requirement, Estimation of losses in the canal, Design of lined and unlined canals and channels, Sediments transport theories, Function of canal regulator, Design of a cross regulator and distributary head regulator, Development, classification & Design of falls, Types, Selection and design of canal outlets, Design consideration of bridges and culverts, Types of canal lining, Economics of canal lining, Maintenance of lined and unlined canals.

SWLE 513**Water Lifting Machines****3 (3-0-0)**

Fundamentals of fluid flow. Introduction and classification of pumps. Centrifugal pumps, components and working, head, capacity, power and efficiency of centrifugal pump. Characteristic curves of centrifugal pump. Cavitation in centrifugal pump. Priming of a centrifugal pump. Factors affecting pump operation and selection of pumps. Reciprocating pumps. Types of reciprocating pumps, main components and working. Discharge, work done and power required to drive reciprocating pump. Single-acting and double-acting reciprocating pump. Coefficient of discharge and slip of reciprocating pumps. Indicator diagrams. Special purpose pumps, bore hole pumps, submergible pumps, jockey pumps, booster pumps etc. Pump tests and trouble shooting.

SES 416**Environmental Studies -II****2 (2-0-0)**

Natural Resources: forest resources, water resources, mineral resources, food resources, energy resources, land resources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life style.

Biodiversity and its conservation: Introduction, definition, genetic, species and ecosystem diversity. Bio geographical classification of India, Value of diversity, consumptive use, productive use, social, ethical aesthet and option values. Biodiversity at global, national and local levels. India as mega-diversity nation. Hot-spot of biodiversity. Threat to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and

endemic species of India. Conservation of biodiversity, In-situ conservation of biodiversity.

Environmental Pollution: definition, Causes effect and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards. Solid waste management: causes effect and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management : flood, earthquake, cyclone and landslides.

Practical: Identification and study of different Natural resources. Determination of chloride in water sample. Determination of pH in water sample. Determination of Acidity in water sample. Determination of hardness in water sample. Determination of alkalinity in water sample. Determination of turbidity in water sample. Identification of different tools for measurement of Environmental pollution.

AET 400

Training – I

1 (0-0-1)

SEMESTER – VI

SWLE 507

Design of Water Resource Structure – II

3 (2-1-0)

Reservoirs planning, Types of Reservoirs, Investigation for reservoirs planning, Site selection and design of reservoir, Economic of reservoir, Classification of dams, Advantages and disadvantages of different types of dams site selection and investigation of dams. Forces acting on gravity dam, rock fill dam and earth dam, design of dams, causes of failure and analysis in gravity dams profile of gravity dam, joints, galleries and construction of gravity dam, foundation requirement in rockfill and earth dam, causes and failure of earth and rockfill and earth dam, design of rock fill and earth dam, seepage analysis, slope stability analysis, seepage control measure, drainage and filters of earth dam, design of Arch dams and spill ways, design of dam outlets and slum ways.

SWLE 508

Ground Water Engineering

3 (3-0-0)

Occurrence distribution & movement of ground water supply, Geologic formation of ground water supply, Ground water possibilities, Aquifer properties; Hydrologic properties of aquifer, Flow through aquifers properties, Properties of water in relation to flow, storage equations, steady and unsteady flow in confined, unconfined & semi confined aquifer, aquifer test partially penetrated aquifers, seepage from canal, stream-aquifer- well interaction, water level measurement in wells, monitoring water level, geologic control, ground water provinces in India, hydro geologic well logging, ground water modeling, ground water development, assessment of usable ground water & ground water balances, ground water recharge, ground water legislation.

SWLE 509

Erosion and Sedimentation in Streams and Reservoirs

3 (3-0-0)

graphical methods. Transitions in subcritical and supercritical flow. Spatially varied flow, basic principle and assumptions, dynamic equations, analysis of flow profile, methods of numerical interaction. Rapidly varied flow, characteristics of the flow, hydraulic jump in horizontal and sloping channels, submerged hydraulic jump. Flow in channel of non-linear alignment and non-prismatic channel sections.

SWLE 609

Water Power Engineering

3 (3-0-0)

Hydraulic turbines, principle of working, velocity triangles, specific and unit quantities, performance characteristics, turbine dimensions, classification of turbines. Hydropower development. Assessment of power potential. Types of hydro-power plants. Components of power station, criteria for selection of number and types of turbines. Water hammer and surge analysis, surge tanks, preliminary design of intakes, conduits, penstocks. Power house dimensions. Development of micro hydel stations, tidal plants, principle of working, assessment of potential. Recent trends in hydropower development. Impact of hydropower development on the environment.

SEMESTER – VII

SWLE 608

Waste Water Engineering

3 (3-0-0)

Wastewater characteristics; composition and microbiology of wastewater, BOD kinetics. Wastewater treatment; Reactor analysis, Unit operations and processes, design of basins, rapid mixing devices, flocculators, filters and disinfection units, Process flowsheets. Theory and Design of biological treatment processes and units including activated sludge process. Trickling filter, Waste stabilization ponds, aerated lagoon and oxidation ditches. Anaerobic treatment of sludges and disposal, septic tanks.

SWLE 611

Water Quality Management

3(2-0-1)

The Physical chemical, Biological and hydrological characteristics of surface water system in junction to water quality management; characterization of water quality in natural system; Contamination of water quality due to human activity; Engineering Management practices and methodologies, with particular emphases on total maximum daily load and waste load location approaches for minimizing contaminant inputs; water quality problems domains in stream and river system, lakes reservoirs and ground water system; Ecological principles impacting water quality; Hydrologic and hydraulic principles relating to water quality monitoring; Assessment, remediation, planning and management, and post audit/monitoring strategies; Various pollution constituents point and nonpoint diffused surface subsurface interaction; State and Federal water quality legislation and permits; standards and criteria; Treatment methods: aeration, nutrient inactivation, biological manipulation, etc.

Practical: Determination of all Physio Chemical properties of water; pH; temperature; Conductive; Dissolved Oxygen; Nitrate; Nitrite; Fecal; Coliform; Turbidity Hardness; BOD.

SWLE 512**Waste Land Management****3 (3-0-0)**

Land suitability classification according to USBR; Land suitability categorizes according to FAO framework; Land evaluation; Mapping of degraded soil through soil survey; Land degradation in arid semiarid regions; Land degradation due to erosion, Land degradation management by soil conservation practices, Causes, Reclamation and management of water logged and salt affected soils, Rehabilitation and management of ravine lands, Selection, Design, and management of Irrigation and drainage system in watersheds, Economic evaluation of watershed development projects.

SWLE 602**Water Harvesting and Ground Water Recharge****3 (3-0-0)**

Water harvesting; Scope, need & types of water harvesting, long term & short term water harvesting techniques, water harvesting structures, design of water harvesting structure & ponds, water harvesting techniques for hilly and arid region.

Reservoir type storage structures; Definition and types, storage or conservation reservoirs, flood control reservoir, multipurpose reservoir & distribution reservoirs planing & site selection, water yields for catchments, estimation of runoff, reservoir components, capacity –elevation curves of reservoir, storage zones of reservoirs, design of reservoirs capacity, Bibliographical and analytical method; Stenz's table Barlow table, Lacy's formula, Inglis formula, Khosla formula, determining reservoir capacity for a given demand & vise versa, Demand pattern of various reservoirs, Hydrologic reservoir routing method, Sedimentation, Reservoir losses spillway design.

SWLE 603**Operation, Maintenance and Economic Evaluation of Water Resource Projects****3 (3-0-0)**

Physics surface irrigation; Design and evaluation procedure for border, Check basin and furrow irrigation; Guidelines for operational and maintenance and surface irrigation methods. Description of quick coupling, Dragline and moveable sprinkler irrigation systems and center Pivot system; Design, installation operation and maintenance of sprinkler irrigation systems; spray losses and drop size distribution in sprinkler irrigation systems and efficiency evaluation. Suitability of drip irrigation system under Indian conditions; Types of drip irrigation systems; Emitter types; Emitters construction; Discharge of principles for emitters; design of drip irrigation systems;

Data requirements and survey, Topographical, geological, hydrological, socio-economic technological; Market survey; Identification of alternate options and associated data requirements and survey, Project feasibility; Demand assessment; Planing period and time horizon, economic –demographic projections, integrated and desegregated analysis and model building; Demand resilience and consumer behavior, Basic economic concept: present worth, future worth, annuities, discounting techniques, depreciation, Production

