



**KALINGA
UNIVERSITY**

SCHEME & SYLLABUS FOR

Bachelor of Vocational Studies (B.Voc.) Soil Water Conservation



Kalinga University, Naya Raipur, Chhattisgarh

B.VOC IN SOIL WATER CONSERVATION

Semester-01								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVSWC101	Communication Skills	3	3	0	0	30	70	100
BVSWC102	Fundamentals of Information Technology	3	3	0	0	30	70	100
BVSWC103	Fundamental of Soil and Water Conservation	3	3	0	0	30	70	100
BVSWC104	Introductory Agro-meteorology and Climate Change	3	3	0	0	30	70	100
BVSWC105P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
Total		30	12	0	36	170	430	600

Semester-02								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVSWC201	Agricultural Drainage Systems	3	3	0	0	30	70	100
BVSWC202	Environmental Studies	3	3	0	0	30	70	100
BVSWC203	Fundamentals of Geology	3	3	0	0	30	70	100
BVSWC204	Fundamentals of Watershed	3	3	0	0	30	70	100
BVSWC205P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
Total		30	12	0	36	170	430	600

Semester-03								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVSWC301	Water Resource Management	3	3	0	0	30	70	100
BVSWC302	Groundwater Hydrogeology and Geophysical Exploration	3	3	0	0	30	70	100
BVSWC303	Water Supply Systems	3	3	0	0	30	70	100
BVSWC304	Biological Aspects of Soil Conservation	3	3	0	0	30	70	100
BVSWC305P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
Total		30	12	0	36	170	430	600

Semester-04								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVSWC401	Soil and Water Conservation Engineering	3	3	0	0	30	70	100
BVSWC402	Wasteland Development and Management	3	3	0	0	30	70	100
BVSWC403	Soil Water Plant Relationship	3	3	0	0	30	70	100
BVSWC404	Soil Erosion and Sedimentation	3	3	0	0	30	70	100
BVSWC405P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
Total		30	12	0	36	170	430	600

Semester-05								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVSWC501	Water Resource Engineering	3	3	0	0	30	70	100
BVSWC502	Climate Change and Water Resources	3	3	0	0	30	70	100
BVSWC503	Ground Water Engineering	3	3	0	0	30	70	100
BVSWC504	Irrigation Engineering	3	3	0	0	30	70	100
BVSWC505P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
Total		30	12	0	36	170	430	600

Semester-06								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVSWC601	Watershed Management and Modeling	3	3	0	0	30	70	100
BVSWC602	Advanced Soil and Water Conservation	3	3	0	0	30	70	100
BVSWC603	Dry land Water Management Technologies	3	3	0	0	30	70	100
BVSWC604	GIS and Remote Sensing for Land and Water Resource	3	3	0	0	30	70	100
BVSWC605P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
Total		30	12	0	36	170	430	600

SEMESTER-01

BVSW101

COMMUNICATION SKILLS

Course Objective:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

Course outcomes:

- The purpose of this course is to introduce students to the theory, fundamentals and tools of communication
- To develop vital communication skills which should be integral to personal, social and professional interactions.
- One of the critical links between human beings.
- An important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal.
- In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

Unit - 1

06

Introduction: Theory of communication, types and modes of communication, mediums and channels of communication, barriers to communication, English as a global language, the lingua franca, social influences on English

Unit - 2

06

Language of Communication: Verbal and non-verbal (spoken and written) personal, social and business barriers and strategies intra-personal, inter-personal and group communication, varieties of English, language, accent, dialect, colloquialism, historical influences on English

Unit - 3

06

Speaking Skills: Monologue dialogue group discussion effective communication/ mis-communication interview public speech, regional influences on English, convergence and divergence, linguistic imperialism

Unit - 4

06

Reading and Understanding Close reading, reading analysis of a text - audience and purpose, content and theme, tone and mood, stylistic devices, structure comprehension- analysis and interpretation translation (from Indian language to English and vice-versa) literary/knowledge texts

Unit - 5

Writing Skills: Documenting report writing making notes letter writing, writing tabloids, diary entry, open letters, essays, newsletter and magazine articles, skits, short stories, impersonating characters it will enhance language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note taking etc. while, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. it is hoped that after studying this course, students will find a difference in their personal and professional interactions.

References:

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul, Dr. Brati Biswas

BVSWC102

FUNDAMENTALS OF INFORMATION TECHNOLOGY

Course objective:

This is a basic course for commerce students to familiarize with computer and its applications in the relevant fields and exposes them to other related courses of IT.

Course Outcomes:

- Gain a foundational understanding of key IT concepts, including hardware, software, and networks.
- Develop proficiency in using common computer applications, such as word processing and spreadsheet software.
- Explore the ethical and security considerations in IT, emphasizing responsible digital behaviour.
- Acquire problem-solving skills by applying IT knowledge to real world scenarios.
- Prepare for further studies in IT or related fields by establishing a strong IT knowledge base.

Unit - 1

06

Computer characteristics: Speed, storage, accuracy, diligence; digital signals, binary system, ASCII; historic evolution of computers;

Classification of computers: microcomputer, minicomputer, mainframes, supercomputers;

Personal computers: desktop, laptops, palmtop, tablet; hardware & software; von Neumann model.

Unit - 2

06

Hardware: CPU, memory, input devices, output devices.

Memory units: RAM (SDRAM, DDR RAM, RDRAM etc. feature wise comparison only); ROM-different types: Flash memory;

Auxiliary storage: Magnetic devices, optical devices; floppy, hard disk, memory stick, CD, DVD, CD/DVD-Writer;

Input devices - keyboard, mouse, scanner, speech input devices, digital camera, touch screen voice input, joystick, optical readers, bar code reader;

Output devices: Display device, size and resolution; CRT, LCD, LED;

Printers: Dot-matrix, inkjet, laser; plotters, sound cards & speaker.

Unit - 3

06

Software: System software, application software; concepts of files and folders, introduction to operating systems, different types of operating systems: single user, multitasking, time-sharing multi-user; booting, POST;

Basic features of two GUI operating systems: Windows & Linux (Basic desk top management); Programming Languages, Compiler, Interpreter, Databases;

Application software: Generic features of word processors, spread sheets and presentation software; generic introduction to latex for scientific typesetting; utilities and their use; computer viruses & protection, free software, open source.

Unit - 4

06

Computer Networks and Internet: Connecting computers, requirements for a network: server, workstation, switch, router, network operating systems; internet: brief history, world wide web, websites, URL, browsers, search engines, search tips; internet connections: isp, dial-up, cable modem, well, dsl, leased line wireless and Wi-Fi connectivity ; email, email software features (send receive, filter, attach, forward, copy, blind copy); characteristics of web-based systems, web pages, web programming languages.

Unit - 5

06

Information Technology and Society: Indian IT Act, intellectual property rights, issues. application of information technology in railways, airlines, banking, insurance, inventory control, financial systems, hotel management, education, video games, telephone exchanges, mobile phones, information kiosks, special effects in movies.

Programming Concepts & Techniques: Program concept, characteristics of programme, stages in program development, tips for program designing, programming aids, algorithms, pseudo code, notations, design, flowcharts, symbols, rules, compiler & interpreter. introduction to programming techniques, top-down & bottom-up approach, unstructured, & modular programming, cohesion, coupling, debugging, syntax & logical errors, linking and loading, testing and debugging, documentation.

References:

1. Programming in C, R.S. Salaria, Khanna Publishing House
2. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
3. Handbook of Computer Fundamentals, N.S. Gill, Khanna Publishing House

BVSWC103

FUNDAMENTAL OF SOIL AND WATER CONSERVATION

Unit - 1	08
<ul style="list-style-type: none">• Introduction to Soil and Water Conservation.• Causes of soil erosion.• Definition and agents of soil erosion.	
Unit - 2	08
Water erosion: <ul style="list-style-type: none">• Forms of water erosion.• Gully classification and control measures.• Soil loss estimation by universal Loss Soil Equation.• Soil loss measurement techniques.	
Unit - 3	07
Principles of erosion control: <ul style="list-style-type: none">• Introduction to contouring. strip cropping.• Contour bund.• Graded bund and bench terracing.• Grassed water ways and their design.• Water harvesting and its techniques.	
Unit - 4	07
Wind erosion: <ul style="list-style-type: none">• Mechanics of wind erosion• Types of soil movement.• Principles of wind erosion control and its control measures.	

BVSWC104

INTRODUCTORY AGRO-METEOROLOGY AND CLIMATE CHANGE

Unit - 1

08

Meaning and scope of agricultural meteorology:

- Earth atmosphere- its composition, extent and structure,
- Atmospheric weather variables; Atmospheric pressure, its variation with height, Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze;
- Nature and properties of solar radiation. solar constant, depletion of solar radiation, short wave.
- long wave and thermal radiation, net radiation

Unit - 2

08

- **albedo:** Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of ear Atmospheric humidity, concept of saturation, vapor pressure, process of condensation,
- formation of dew, fog. mist, frost, cloud;
- **Precipitation:** process of precipitation. types or precipitation such as rain. snow. sleet, and hail, cloud formation and classification: Artificial rainmaking.

Unit - 3

07

Monsoon:

- mechanism and importance in Indian agriculture, Weather hazards- drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave.
- Agriculture and weather relations; Modifications of crop microclimate, climatic normal for crop and livestock production.

Weather forecasting

- types of weather forecast and their uses.

Unit - 4

07

Climate change:

- climatic variability
- global warming
- causes of climate change and its impact on regional and national Agriculture.

BVSWC105P

INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP

SEMESTER-02

BVSWC201

AGRICULTURAL DRAINAGE SYSTEMS

Course Objectives:

To acquaint and equip with the importance and phenomenon of drainage system along with design consideration of surface and sub-surface drainage systems.

Unit - 1 **06**
Theories and applications of surface and sub-surface drainage, steady state, unsteady state drainage equations for layered and non-layered soils, horizontal sub-surface drainage.

Unit - 2 **06**
Principle and applications of Earnst, Glover Dumm, Kraijenhoff-van-deleur equations.

Unit - 3 **06**
Salt balance, leaching requirement and management practices under drained conditions.

Unit - 4 **06**
Design of different components of sub-surface drainage systems, theories of vertical drainage and multiple well point system.

Unit - 5 **06**
Disposal of drainage effluents, Management of drainage projects of water logged and saline soils, case studies.

References:

1. Battacharaya AK & Micheal AM. 2003. Land Drainage. Vikas Publ. Claude Ayres & Daniel Scoates A.E. 1989. Level Drainage and Reclamation. McGraw Hill. Luthin JN. 1978. Drainage Engineering. Wiley Eastern.
2. Ritzema HP. (Ed.). 1994. Drainage Principles and Applications. ILRI Roe CE 1966. Engineering for Agricultural Drainage. McGraw Hill.

BVSWC202

ENVIRONMENTAL STUDIES

Course Outcomes:

- Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.

Unit - 1

06

Introduction to Environmental Studies:

Multidisciplinary nature of environmental studies, Scope & importance; concept of sustainability & sustainable development.

Ecosystems:

- What is an ecosystem? Structure and function of the ecosystem;
- **Energy flow in an ecosystem:** food chains, food webs and ecological succession.
- **Case studies of the following ecosystems:** Forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit - 2

06

Natural Resources:

- **Renewable and Non-renewable Resources:** Land resources and land use change; Land degradation, soil erosion and desertification
- **Deforestation:** Causes & impacts due to mining, dam building on environment, forests, biodiversity & tribal populations
- **Water:** Use & over-exploitation of surface & ground water, floods, droughts, conflicts over water (international & inter-state)
- **Energy resources:** Renewable & non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies

Unit - 3

06

Biodiversity and Conservation:

- **Levels of biological diversity:** genetic, species & ecosystem diversity; Biogeographic zones of India; Biodiversity patterns & global biodiversity hot spots, India as a mega-biodiversity nation; Endangered & endemic species of India
- **Threats to biodiversity:** Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions;
- **Conservation of biodiversity:** In-situ and Ex-situ conservation of biodiversity.
- **Ecosystem and biodiversity services:** Ecological, economic, social, ethical, aesthetic and Informational value.

Unit - 4

06

Environmental Pollution:

- Types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks
- **Solid waste management:** Control measures of urban and industrial waste. Pollution case studies.

Environmental Policies & Practices:

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- **Environment Laws:** Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit - 5

06

Human Communities and the Environment:

- **Human population growth:** Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies.
- **Disaster management:** floods, earthquake, cyclones and landslides.
- **Environmental movements:** Chipko, Silent valley, Bishnois of Rajasthan.
- **Environmental ethics:** Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

References:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36--37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29--64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. Tripathi 1992.
14. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.

BVSWC203

FUNDAMENTALS OF GEOLOGY

Course Outcomes:

- Students would be able to explain the basics of minerals, rocks and its properties.
- Students would be able to explain the different types of geomorphic processes and drainage patterns.
- Students would be able to describe the different types of geomorphic landforms and its characteristics.
- Students would be able to describe the geological structures like folds, faults, fractures, joints and unconformities.
- Students would be able to explain the atmosphere, hydrosphere, lithosphere and their constituents.

Unit - 1

06

- **Introduction of Geology:** A brief history of the earth through geological time.
- Interior of the Earth.
- **Minerals:** Definition, physical properties.
- Rocks: Definition, types of rocks: Igneous, sedimentary and metamorphic.
- Structure, texture and classification of these rocks.

Unit - 2

06

- **Geomorphology:** Geomorphic processes, endogenic and exogenic.
- **Weathering:** Mechanical, chemical and biological weathering, drainage pattern and their significance.
- Drainage basin, morphometric and hypsometric analysis of drainage basin.

Unit - 3

06

Geomorphic agents, erosional and depositional landforms produced by geomorphic agents: Fluvial, coastal, glacial and aeolian landforms and karst topography.

Unit - 4

06

- Rock as layers (beds), their attitude. Geological structures like folds, faults, fractures joints and unconformities – their nomenclature, classification and recognition.
- Importance of these structures in groundwater exploration and water resource management.

Unit - 5

06

- Atmosphere, hydrosphere, lithosphere and their constituents.
- Physiographic division of India, weather and climate.
- **Precipitation:** types, distribution, factors controlling distribution, seasonal variation and intensity of precipitation.

References:

1. Kevin Helloran and John O'Brien (2010), Earth materials, John Wiley and Sons
2. Mahapatra G.B , Textbook of Physical geology, CBS Publ.
3. Lal D.S (2011), Climatology, Sharda Pustak Bhavan
4. Tyrell, G. W. (1963), Principles of Petrology, Metheun
5. Jain, S. (2014), Fundamentals of Physical Geology, Springer

BVSWC204

FUNDAMENTALS OF WATERSHED

Course Objectives:

- Students would be able to explain the basic concepts of watershed.
- Students would be able to understand the irrigation water management and methods of water application to crop.
- Students would be able to describe the afforestation, deforestation and agroforestry.
- Students would be able to distinguish between arable and non-arable land, waste land and its management.
- Students would be able to understand the guidelines of watershed development programs in India.

Unit - 1

06

- **Watershed:** Introduction, concept, principal, scope, coding, need, delineation, characterization, identification of watershed and its significance, objectives of watershed development, multidisciplinary approach for watershed management.
- Watershed causes of deterioration.

Unit - 2

06

- **Irrigation Water Management:** Crop season, crop selection, crop rotation and irrigation schedule.
- **Method of water application to crop:** surface method, sprinkler method, drip method and subsurface method.
- **Water conveyance and application method:** lined and unlined canals.

Unit - 3

06

- **Afforestation in Watershed:** Utility of forests, classification of forests, advantages of afforestation.
- **Deforestation:** Definition causes and impact.
- **Agroforestry:** Definition, objective, importance, benefits and conservation of natural resources through agroforestry.

Unit - 4

06

- **Arable land:** Introduction, agriculture and horticulture.
- Non- arable land: Introduction, forestry, fishery and animal husbandry.
- **Wasteland, causes of wasteland:** water logging, salinity, overgrazing, mining operation, industrial effluent, remedial measures in wasteland management.

Unit - 5

06

Guidelines of watershed development programs in India. Watershed based rural development. Urban watershed development: Goals and strategies. Selection of watershed development and management agency, case study.

References:

1. Das M. M. and Saikia M.D (2013), Watershed Management, PHI Learning Pvt. Ltd.
2. Khan M. A. (2006), Watershed management for sustainable agriculture, Agribios (India)
3. Murthy V. V. N. (2007), Land and Water Management engineering, Kalyani Publications.
4. Tideman, E.M., (1996), Watershed Management: Guidelines for Indian Conditions, Omega Scientific Publishers, New Delhi.

BVSWC205P
**INDUSTRIAL TRAINING/ON JOB TRAINING/
WORKSHOP**

SEMESTER-03

BVSWC301

WATER RESOURCE MANAGEMENT

Course Objectives:

- Acquire the basic principles of water resources and its planning and management.
- Enhance the knowledge on recent technologies in assessing the water resources.
- Identify the challenges facing water management in varied climate types around the world.

Course Outcomes:

Upon completion of this course, the student will be able to:

- Understand the planning of water resources and need for water resource management.
- Understand the water resource potential in global, India scenario and explore the water resources using different technologies.
- Acquire a knowledge international and national water law and its policy.
- Explain the concept of water in agricultural and economic aspects.
- Predict the future trends of water demand and its management during crisis.

Unit - 1

06

Water, A Multi-Dimensional Resource:

Water resources planning-Multi-dimensional management-Water withdrawal and consumption by sector-Stress, international policy-Climate change, oceans, challenges and need for water resource management.

Global and Indian Scenario for Water Resources:

Surface Water and Groundwater Global and Indian Scenario-Quality of water resources Water use and sustainable reuse methods-Usable water resources by continent and country-Water footprint.

Unit - 2

06

Water Resources Assessment:

Network design-Stream flow gauging-Weir design-Gauges-Current gauging-Salt dilution Geophysical exploration-Test drilling-Application of remote sensing techniques.

Unit - 3

06

Water in Agricultural Systems:

Water for food production, virtual water trade for achieving global water security, irrigation efficiencies, irrigation methods and current water pricing, water for livestock and processing, water pollution from agricultural production

Unit - 4

06

Water Economics:

Economic characteristics of water good and services-Nonmarket monetary valuation methods-Water economic instruments-Policy options for water conservation and sustainable use, pricing, distinction between values and charges-Private sector involvement in water resources management.

Unit - 5

Water Legal and Regulatory Settings:

- National and International Framework for Water Law; Basic structure of water law- An overview of water law in India -Evolution of water law, key features of water law, evolving water law and policy- Water policy for Irrigation, decentralization and participation in irrigation management, and the policy measures proposed to establish water user associations.
- National level initiatives for regulation of groundwater, State groundwater laws and rainwater harvesting.

Demand Management:

Balancing supply and demand-Economic theory of supply and demand-management by use of tariffs- Timing, long-term, operational time-frame-Crisis management-Cost of water-Future trends-Economic value of water-Loss control-Water harvesting.

References:

1. David Stephenson, Water Resources Management, 2004, A. A. Balkema Publishers, Netherlands.
2. Louis Theodore, Ryan Dupont R., Water Resource Management Issues, Basic Principles and Applications, 2020, CRC Press, Taylor & Francis Group, New York.
3. Philippe Cullet and Sujith Koonan, Water Law in India- An Introduction to Legal Instruments, 2017. Second Edition, Oxford University Press, New Delhi.
4. Subramanya. K., Engineering Hydrology, 2020, Fifth Edition, McGraw Hill Education Pvt. Ltd., New Delhi.

BVSWC302

GROUNDWATER HYDROGEOLOGY AND GEOPHYSICAL EXPLORATION

Course Outcomes:

- Students would be familiar with the main aspects of the groundwater and its availability.
- Students would be able to understand the aquifer characteristics.
- Students would be able to understand the different types of water qualities.
- Students would be able to describe the quality criteria for groundwater supplies.
- Students would be able to understand concept of the groundwater exploration.

Unit - 1

06

- **Groundwater origin, types, importance. Groundwater occurrence:** Vertical distribution of ground Water.
- **Water bearing properties of rocks:** Porosity, permeability, specific yield, specific retention, hydraulic conductivity, transmissivity and storage coefficient.
- **Ground water flow-** movement of ground water, Darcy's law and its validity.

Unit - 2

06

- **Classification of rocks base on porosity and permeability:** Aquifer, aquitard, aquiclude, aquifuge. Geological formations as aquifers.
- **Types of aquifers:** Confined, unconfined, semi-confined perched aquifer. Recharge of aquifer, artificial recharge, mode of occurrence of groundwater in different geological terrains of India.

Unit - 3

06

Physical, chemical and bacteriological quality of water. Dissolved constituents in groundwater (major, minor and trace elements). Changes in the chemical compositions. Chemical processes occurring in groundwater-dissolution and precipitation. Adsorption and ion exchange, mixing, oxidation, reduction.

Unit - 4

06

Quality criteria for groundwater supplies: Drinking, domestic, irrigation, and industrial use. Pollution of surface and sub-surface water, its health hazards, water quality monitoring and preventive measures. Conjunctive and consumptive use of water.

Unit - 5

06

Groundwater exploration: Ground water prospecting, geological and surface geophysical methods for the selection of suitable site for well construction. Type and design of wells, methods of well construction, well completion and well development. Geophysical methods in ground water exploration: Basic principles, types, field procedure, profiling, interpretation of data and applications.

References:

1. Raghunath N.M. (1982), Ground Water, Wiley Eastern.
2. Eugene W. Rice, (2012), Standard Method, APHA Publisher.
3. Karanth, K.R. (1987), Groundwater Assessment - Development and Management. Tata Mc-Graw Hill.
4. Sharma P.V. (1986), Geophysical Methods in Geology, Elsevier.
5. Akhauri Sanjay and Akhauri H. M. (2015), Fundamentals of Hydrogeology, Zobra Books.

BVSWC303

WATER SUPPLY SYSTEMS

Course Outcomes:

At the end of the course, student will be able to:

- Gives a broad outline of the various facets of water usage in daily life.
- Narrates the origin of Natural waters and also to synthesize it for regular use.
- How to conservative drinking water and how to utilize non-potable water for various other uses.
- Explains how the water from a reservoir reaches the consumer.
- Explains how an industry requires specific water for its operations and also characteristics of waste water it generates and their general treatment before disposal.

Unit - 1

06

Water and Life:

Necessity of water – Domestic demand – Public demand – Irrigation – Transportation – Sanitation – Dilution of waste waters – Dust palliative – Recreation – Fire protection.

Unit - 2

06

Sources of Water: Surface sources – Ground sources – Water from atmosphere – Desalination – Recycling of waste water – Recharging of aquifers.

Unit - 3

06

Dual Supply of Water:

Potable and non-potable water – Protected water – Grey water – Black water – Water borne diseases – water related diseases – Sewage Irrigation.

Unit - 4

06

Distribution of Water:

- Based on topography – Gravity distribution – Direct pumping – Combined pumping and gravity flow.
- Service Reservoirs – Continuous supply – Intermittent supply – Networks of distribution – Emergency water supply as in case of fire accidents – Valves, hydrants and meters.

Unit - 5

06

Industries and Water:

Location of Industry with reference to surface sources of water – Quality of water required for industrial Operations – characteristics of waste water produced – Standards for letting industrial effluents into sources of water.

References:

1. Environmental Engineering by S.K. DUGGAL
2. Water and Waste water technology by Hammer and Hammer
3. Environmental engineering by Peery, Rowe and Tehabanaglous

BVSWC304

BIOLOGICAL ASPECTS OF SOIL CONSERVATION

Unit - 1	08
Concept of conservation farming and irrigation, role of vegetation, conservation tillage and mulch in various land, climate conditions.	
Unit - 2	08
Biological measures in dryland, rainfed, arid, semi-arid, and humid lands.	
Unit - 3	07
Water use efficiency soil fertility, selection of draught tolerant plants, role of grasses, legumes in conservation, pasture and range-land management and its improvement.	
Unit - 4	07
Management of waterways, canal bank, bench terrace through biological means.	

BVSWC305P
**INDUSTRIAL TRAINING/ON JOB TRAINING/
WORKSHOP**

SEMESTER-04

BVSWC401

SOIL AND WATER CONSERVATION ENGINEERING

Course Objectives:

- Providing knowledge on different surveying methods used in agricultural field
- Imparting knowledge on the loss of soil and techniques to conserve soil
- Describing techniques of water harvesting and watershed concepts

Course Outcomes:

At the end of the course the student should be able to

- Apply different surveying methods to measure area in agricultural field
- Determine soil loss for a specific area based on erosivity and erodibility factor
- Relate different techniques to control wind erosion
- Apply rain water harvesting methods to conserve water
- Interpret case studies related to soil and water conservation
- Design irrigation systems and plan erosion control measures

Unit - 1

08

Surveying, soil and water erosion:

- **Surveying and leveling:** chain, compass, plane table survey, land measurement and computation of area. Simpson's rule and Trapezoidal rule.
- **Soil erosion:** causes, effects of soil erosion, geologic and accelerated erosion. Universal soil loss equation. Soil loss measurement techniques.
- **Water erosion:** causes, forms, erosivity and erodibility. Mechanics of water erosion: splash, sheet, rill and gully erosion.

Unit - 2

08

Erosion control and conservation techniques:

- **Biological measures:** contour cultivation, strip cropping and cropping systems.
- **Vegetative measures:** XXXetiver and other natural grass barriers. Mechanical measures: contour bund, graded bund, broad beds and furrows, basin listing, random tie ridging.
- **Mechanical measures for hill slopes:** contour trench, bench terrace, contour stone wall and gully control structures.

Unit - 3

07

Wind erosion:

- Factors influencing wind erosion.
- **Mechanics of wind erosion:** suspension, saltation and surface creep. Control measures: windbreaks and shelterbelts. Sand dunes and their stabilization.

Unit - 4

Rain water harvesting:

- **In-situ soil moisture conservation:** micro catchments and eroded catchments.
- **Roof water harvesting:** storage and its use for domestic and groundwater recharge.
- Farm ponds and percolation ponds.
- Watershed concept and watershed management.

References:

1. Huffman, Rodney L., Delmar D. Fangmeier, William J. Elliot, and Stephen R. Workman. 2013. Soil and Water Conservation Engineering, 7th edition. American Society of Agricultural Engineers. Michigan, USA.
2. Khan Towhid Osman. 2013. Soil Degradation, Conservation and Remediation. Springer, Germany.
3. Ghanashyam Das. 2009. Hydrology and Soil Conservation engineering: Including Watershed Management. Prentice Hall India Learning Private Limited, India.
4. Gurmail Singh et al., 1990. Manual of soil and water Conservation practices in India. Oxford & IBH Publishing Co., New Delhi, India.

BVSWC402

WASTELAND DEVELOPMENT AND MANAGEMENT

Unit - 1	06
Wasteland – definition, concept, development and classification. Estimates of wastelands in India.	
Unit - 2	06
<ul style="list-style-type: none">• Degraded forest lands – extent of degraded forests – history and causes of degradation.• Assessment and criteria for soil degradation, sedimentation and desertification.	
Unit - 3	06
Role of climatic factors (water and temperature) for soil degradation.	
Unit - 4	06
Technological development for management of various types of wastelands - hot desert, saline-alkali, ravine, coastal soils, laterites, rocky eroded hill slope, coal mine areas etc.	
Unit - 5	06
Environmental consideration for the wasteland development.	

BVSWC403

SOIL WATER PLANT RELATIONSHIP

Unit - 1	06
<ul style="list-style-type: none">• State of water in soil and its classification- gravimetric, capillary and hygroscopic moisture.• Retention and drying characteristics of soil moisture.	
Unit - 2	06
<ul style="list-style-type: none">• Energy concepts of soil water.• Thermodynamic concept of soil water potential, significance and evaluation of total and its component potentials.• Soil water retention and movement, field capacity, wilting point, water holding capacity and available water.	
Unit - 3	06
<ul style="list-style-type: none">• Soil water storage and its depletion.• Mechanism of soil moisture absorption by plants.	
Unit - 4	06
<ul style="list-style-type: none">• Evapotranspiration and potential evapotranspiration.• Soil moisture determination, soil moisture stress and plant growth.	
Unit - 5	06
<ul style="list-style-type: none">• Estimation of water requirement by empirical formulae – Thornthwite equation, Pen man's equation, Blanney-Cridle equations.• Critical analysis of the equations. Irrigation water quality in relation to soil and plant water.• Measurement of soil water – lysimeter tensiometer, moisture meter, pressure plate etc.	

BVSWC404

SOIL EROSION AND SEDIMENTATION

Course Objective:

To teach the concepts, factors, methods of prediction and measurement of erosion and sedimentation & control measures.

Unit - 1

06

Soil erosion – man and soil erosion, geographical distribution of erosion, geological and accelerated erosion, forms and amount of erosion, magnitude of soil erosion damage in India, acceptable limits of erosion.

Unit - 2

06

Rainfall characteristics related to soil erosion-erosivity of rainfall. Land factors affecting erosion-erodibility of soil. Surface runoff and its estimation, rainfall–runoff–soil interactions.

Unit - 3

06

Erosion prediction – universal soil loss equation. Wind erosion. Gully erosion. Loss of soil and plant nutrients in erosion. Off-site and on-site effects of erosion.

Unit - 4

06

- Principle of erosion control. Control of erosion on arable and non-arable land.
- **Sedimentation** – causes, movement of sediments, sediment characteristics, sediment deposit, method of measurement– stream gauging and reservoir siltation, sediment delivery ratio, silting of reservoirs in India and control measures.

Unit - 5

06

Soil erosion problem in India with special reference to NEH region, shifting cultivation problem and alternative strategies.

References:

1. Ahmad, E. 1973. Soil erosion in India. Asia Publishing House, New Delhi.
2. Blanco, H. and R. Lal. 2008. Principles of Soil Conservation and Management, Springer.
3. Chauhan, B.S. (2001) Shifting Cultivation in perspective. Nagaland University, Kohima, India.
4. Follet, R.F. and B.A. Stewart (eds.). 1985. American society of Agronomy., Crop Science
5. Society of America., Soil Science Society of America, Inc., Publishers, Madison, Wisconsin, USA.
6. Garde, R.J. and K.G. Ranga Raju. 1977. Mechanics of sediment transport and alluvial stream problems. Wiley Eastern Ltd., New Delhi.
7. Harold, G. 1985. Erosion – its causes and cure. International Books and Periodical supply services, New Delhi.
8. Hudson, N. 1989. Soil Conservation. B.T. Botsford, London.

BVSWC405P

INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP

SEMESTER-05

BVSWC501

WATER RESOURCE ENGINEERING

Course Objectives:

- To motivate the students to identify, formulate, solve the complex problem to manage the water resource related issues.
- To prepare the students to synthesize data and technical concepts to apply in water resources engineering.
- To get the exposure about the concept of irrigation and flood control.
- To provide the students an opportunity to work as a part of a project team.
- To train the students for a successful career in water resources engineers

Course Outcomes:

- Identify the various components of hydrological cycle and the spatial and temporal variation of rainfall.
- Determine the different methods and hydrological models to estimate the stream flow.
- Examine the different techniques to calculate the probable maximum flood based on different returned period.
- Evaluate the basic aquifer parameters and groundwater resources for different hydrogeological boundary conditions.
- Understand the different methods of irrigation and find the optimum methods of irrigation for judicious use of water resources.

Unit - 1

06

Precipitation Measurement and Analysis:

Hydrologic cycle and budget, Precipitation variability, rainfall and snow measurement techniques, design of precipitation gauging network, Hydrologic Abstractions-Infiltration-evaporation-evapotranspiration-interception and depression storage, rain harvesting-design procedure.

Unit - 2

06

Stream Flow:

Measurement of stream flow; factors affecting stream flow; hydrograph analysis, base flow separation, unit hydrograph and curve number methods of stream flow determination, synthetic unit hydrograph, hydrological modeling for stream flow estimation, methods for peak discharge estimation.

Flood Analysis:

Design flood estimation, frequency analysis, flood routing, storm drainage design, flood migration, flood damage analysis.

Unit - 3

06

Ground Water:

Ground water hydrology, Application of Darcy's law and Aquifer characteristics, Models for Groundwater flow analysis, steady state well hydraulics – Fundamentals of unsteady state.

Unit - 4

Irrigation Practices:

Need for Irrigation in India, Scope, National Water Policy, Physical properties of soil that influence soil moisture characteristics – Concept of soil water potential and its components, Crop water requirements- Irrigation Scheduling- Irrigation efficiencies – Duty-Delta-base period, Surface and Subsurface methods of Irrigation, Standards for irrigation water, Water logging and consequences – Salinity and alkalinity- Reclamation

Unit - 5

Canal Irrigation:

Classification of canals, Alignment of canals, Design of rigid boundary canals, Lacey's and Tractive force concepts in canal design, lining of canals; Sediment transport in canals, River training

Irrigation Structure:

Design procedure for –Canal Head works-Canal regulators-Canal drop –Cross drainage works Canal Outlet-Escapes, Lining and maintenance of canals

References:

1. Subramanya. K., " Engineering Hydrology" McGraw Hill Education (India) Pvt. Ltd. (2013) Santosh Kumar Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi, (2013)
2. Chow, V.T., Maidment, D.R. and Mays, W.L., (2010) "Applied Hydrology", Tata McGraw Hill Education Pvt. Ltd.
3. Punmia. B. C., Ashok Kumar Jain, Arun Kumar Jain and Pande Brij Basilal, (2012) "Irrigation and Water Power Engineering", Laxmi Publications (P) Ltd.
4. Mays, L.W.(2010). Water Resources Engineering, John Wiley and sons.
5. Todd D.K. and Larry W. Mays (2005)"Groundwater Hydrology", John Wiley & Sons, Inc, New York.
6. A.K. Rastogi, (2011) "Numerical Groundwater Hydrology", Penram International Publishing (India) Pvt. Ltd.

BVSWC502

CLIMATE CHANGE AND WATER RESOURCES

Course Objectives:

To acquaint students about the concept of climate change and its impact on surface and ground water resources. To understand adaptation and mitigation strategy under climate change scenario.

Unit - 1

06

The climate system:

Definitions, climate, climate system, climate change. Drivers of climate change, characteristics of climate system components: Greenhouse effect, carbon cycle, wind systems. Trade winds and the Hadley Cell, ozone hole in the stratosphere, El Nino, La Nina – ENSO, tele connections.

Unit - 2

06

Impacts of climate change:

Observed and projected, global and Indian scenario, observed changes and projected changes of IPCC: Impacts on water resources, NATCOM Report, impacts on sectoral vulnerabilities, SRES, different scenarios, climate change impacts on ET and irrigation demand.

Unit - 3

06

Tools for vulnerability assessment:

Need for vulnerability assessment, steps for assessment, approaches for assessment. Models: Quantitative models, Economic models, impact matrix approach, Box models, Zero-dimensional models, Radioactive- convective models, Higher dimension models, EMICs (Earth-system models of intermediate complexity), GCMs (global climate models or general circulation models), Sectoral models.

Unit - 4

06

Adaptation and mitigation water:

Related adaptation to climate change in the fields of ecosystems and biodiversity, agriculture and food security, land use and forestry, human health, water supply and sanitation, infrastructure and economy (insurance, tourism, industry and transportation), Adaptation, vulnerability and sustainable development.

Unit - 5

06

Sector specific mitigation:

Carbon dioxide capture and storage (CCS), bio-energy crops, biomass electricity, hydropower, geothermal energy, energy use in buildings, land-use change and management, cropland management, afforestation and reforestation. Potential water resource conflicts between adaptation and mitigation. Implications for policy and sustainable development.

References:

1. Majumdar PP and Nagesh KD. Floods in a Changing Climate: Hydrological Modelling. Cambridge University Press, New York.
2. Pathak H, Agarwal PK and Singh SD. Mitigation in Agriculture: Methodology for Assessment and Application. Division of Environmental Sciences, IARI New Delhi.
3. Rao YS, Zhang TC Ojha, Gurjar BR, Tyagi RD, Kao CM(eds). Climate Change Modelling, Mitigation, and Adaptation. American Society of Civil Engineers.
4. SrinivasaRKandNageshKD. ImpactofClimateChangeonWaterResourceswithModelling Techniques and Case Studies. Springer publications, New York.
5. Tamim Y and Caitlin AG. Climate Change and Water Resources. Springer Publication.

BVSWC503

GROUND WATER ENGINEERING

Course Objective:

To acquaint and equip with the occurrence, development and hydraulics of groundwater flow.

Unit - 1	06
Properties affecting groundwater storage and movement, groundwater balance studies.	
Unit - 2	06
Well hydraulics, two dimensional flow, steady and unsteady state flow in confined, unconfined and semi-confined aquifers, steady flow in sloping aquifers, partial penetrating wells. Analysis of multi-aquifers.	
Unit - 3	06
Flow analysis in interfering wells. Pumping tests and determination of aquifer parameters.	
Unit - 4	06
Groundwater modeling for water resources planning.	
Unit - 5	06
Techniques for groundwater recharge.	

References:

1. Boonstra J & de Ridder NA. 1981. Numerical Modeling of Groundwater Basins. ILRI.
2. Domenico PA. 1972. Concept and Models in Groundwater Hydrology. McGraw Hill.
3. Hantush MS. (Ed.). 1964. Advances in Hydro Sciences. Vol. I. Academic Press.
4. Harr ME 1990. Ground Water and Seepage. Wiley Eastern. Huisman L. 1972. Groundwater Recovery. MacMillan.
5. PolubarinovaKochina P Ya 1962. Theory of Ground Water Movement. Princeton Univ. Press.
6. Raghunath HM. 1992. Ground Water. Wiley Eastern. Todd DK. 1997. Ground Water Hydrology. Wiley Eastern.

BVSWC504

IRRIGATION ENGINEERING

Course Objectives:

- To take up the basic concepts of irrigation and construction of various hydraulic structures.
- To introduce students to basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management.
- The structures involved the elementary hydraulic design of different structures and the concepts of maintenance shall also form part.
- To develop analytical skills relevant to the areas mentioned above, particularly the design of irrigation and drainage projects.

Unit - 1

06

Introduction:

Necessity of irrigation- scope of irrigation engineering- benefits and ill effects of irrigation development in India- types of irrigation systems, Soil-water plant relationship: Classification of soil water- soil moisture contents- depth of soil water available to plants permanent and ultimate wilting point

Unit - 2

06

Water requirements of crops:

Depth of water applied during irrigation- Duty of water and delta improvement of duty command area and intensity of irrigation consumptive use of water and evapotranspiration irrigation efficiencies- assessment of irrigation water

Methods of Irrigation:

Classification- choice of method of irrigation- surface and subsurface irrigation methods, Sprinkler and Drip Irrigation

Unit - 3

06

Design of Irrigation Channel:

Alignment- canal capacity- losses- FSL of canal- design of canal in alluvial soil and non-alluvial soils- Kennedy's silt theory- Lacey's regime theory- balancing depth- use of Garrets diagrams and Lacey's Regime diagrams- lining of irrigation channels- design of lined canal drainage behind lining. Water logging: Causes, Measures: surface and sub-surface drains, land reclamation

Unit - 4

06

Diversion head works:

Types- selection of the suitable site for the diversion headwork components of diversion headwork- Causes of failure of structure on pervious foundation- Khosla's theory- Design of concrete sloping glacis weir

Unit - 5

Cross drainage works:

Types- selection of suitable type of CD works- aqueduct and Syphon aqueduct determination of maximum flood discharge and waterway for drain, fluming of canal- uplift pressure on underside of barrel roof and at the floor of the culvert- design of bank connections

Canal regulation works:

Canal fall- necessity and location- types of falls- Cross regulator and distributory head regulator- their functions, Silt control devices, Canal escapes- types of escapes.

References:

1. Modi, P.N., Irrigation Water Resources and Water Power Engineering, Standard Book House, New Delhi.
2. Garg, S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi.
3. Sharma, R.K., Text book of Irrigation Engineering and Hydraulic Structures, Oxford and IBK Publishing House, New Delhi.
4. Sharma, S.K., Principles and Practice of Irrigation Engineering, S. Chand & Company Pvt. Ltd, New Delhi
5. Punmia, B.C., and B.B. Pande, "Irrigation and Water Power Engineering", Laxmi Publication Pvt. Ltd., New Delhi
6. A.M. Micheal, "Irrigation, Theory and Practice", Vikas Publishing House Pvt. Ltd. New Delhi

BVSWC505P

INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP

SEMESTER-06

BVSWC601

WATERSHED MANAGEMENT AND MODELING

Course Objectives:

To acquaint and equip the students with the watershed management modeling and modeling systems

Unit - 1	06
Problems of desertification and degradation. Models of sediment yield	
Unit - 2	06
Survey, monitoring, reclamation and conservation of agricultural and forest lands, hill slopes and ravines	
Unit - 3	06
Concept of operational watershed. National land use policy, legal and social aspects	
Unit - 4	06
Watershed management research instrumentation and measurement, problem identification, simulation and synthesis	
Unit - 5	06
Modelling of flood and drought phenomenon, drought management and dry farming	

References:

1. Isobel W Heathcote. 1998. Integrated Watershed Management: Principles and Practice. Wiley Publ.
2. Kenneth N Brooks, Peter F Ffolliott, Hans M Gregersen, Leonard F DeBano. 1991. Hydrology and the Management of Watersheds. Wiley-Blackwell.

BVSWC602

ADVANCED SOIL AND WATER CONSERVATION

Course Objectives:

To acquaint and equip students with the advances in soil and water conservation measures, use of RS and GIS and Software's for design of soil and water conservation structures.

Unit - 1 **06**
Concept of probability in design of soil and water conservation structures. Probability and continuous frequency distribution Fitting empirical distributions.

Unit - 2 **06**
Relevance of soil and water conservation in agriculture and in the river valley projects. Layout and planning of soil and water conservation measures. Software's for design of conservation structures.

Unit - 3 **06**
Productivity loss due to soil erosion. Water stress and water excess. Types and mechanics of soil erosion. Wind erosion and its control Software's for soil loss estimation, WEAP, EPIC

Unit - 4 **06**
Theories of sediment transport. Control of runoff and sediment loss. Sediment deposition process. Estimation of sediment load.

Unit - 5 **06**
Design of soil and water conservation structures:
Check dams, gully plugs, gabion structures, earth dams, silt detention dams, farm ponds, etc., and the alternate use of the stored water for agriculture. Application of Remote Sensing and GIS in Soil and Water Conservation.

References:

1. Garg SK. 1987. Irrigation Engineering and Hydraulic Structures. Khanna Publishers, New Delhi.
2. Kirk by MJ and Morgan PPC (eds). 1980. Soil Erosion. John Wiley and Sons. New York, USA.
3. Suresh R. 2016. Soil and Water Conservation Engineering. Standard Publishers and Distributors, Delhi.

BVSWC603

DRY LAND WATER MANAGEMENT TECHNOLOGIES

Course Objective:

To provide detail knowledge about analysis of severity of drought assessment and various dry land water management technologies suitable for conservation, harvesting and enhancing productivity of rainfed areas.

Unit - 1

06

Drought severity assessment:

Meteorological, hydrological and agricultural methods. Drought indices. GIS based drought information system, drought vulnerability assessment and mapping using GIS. DPAP programme, drought monitoring constraints, limiting crop production in dry land areas. Types of drought, characterization of environment for water availability, crop planning for erratic and aberrant weather conditions.

Unit - 2

06

Stress physiology and crop resistance to drought, adaptation of crop plants to drought, drought management strategies. Preparation of appropriate crop plans for dry land areas. Mid contingent plan for aberrant weather conditions.

Unit - 3

06

- Land shaping and land development for soil moisture conservation. Improvement of tillage and soil management by implements and engineering practices. Soil and moisture conservation for rainfed lands through improved implements and engineering practices. Gel technology.
- **Ex-situ measures:** Water harvesting-micro catchments.
- **Design of small water harvesting structures:** Farm Ponds, percolation tanks their types and design, recycling of runoff water for crop productivity.

Unit - 4

06

Crops and cropping practices related to soil and moisture conservation. Fertility management in dry land farming. Planning and development of watersheds from engineering view point.

Unit - 5

06

Application of aerial photography in surveys and planning of watersheds for rainfed agriculture. Use of Remote Sensing in soil moisture estimation.

References:

1. Das NR. 2007. Tillage and Crop Production. Scientific Publishers.
2. Dhopte AM.2002. Agro Technology for Dry land Farming. Scientific Publ.
3. GuptaUS.1995.ProductionandImprovementsofCropsforDrylands.Oxford&IBH
4. SinghRP.1988.ImprovedAgronomicPracticesforDrylandCrops.CRIDA.
5. SinghRP.2005.SustainableDevelopmentofDrylandAgricultureinIndia.ScientificPubl.
6. SinghRV.2003.Watershed Planning and Management. Second Edition. Yash Publishing House, Bikaner.

BVSWC604

GIS AND REMOTE SENSING FOR LAND AND WATER RESOURCE

Course Objective:

To acquaint and equip with the techniques of Remote Sensing and application of GIS for land and water resources management.

Unit - 1

08

Basic principles of remote sensing and sensors. Elements of photogrammetry.

Unit - 2

08

Electromagnetic spectrum. Energy interaction with surface features, Aerial photo and satellite imagery. Photo and image interpretation.

Unit - 3

07

Principles of Geographical Information System tools, their types and capabilities, Advantages of GIS over conventional methods.

Unit - 4

07

Importance of ground truth establishment, GIS and remote sensing for land and water resources data collection, analysis and interpretation, Application of GIS in water and land resource development and management.

References:

1. De Mess MN. 2004. Fundamental of Geographic Information System. John Wiley & Sons.
2. Lille Sand T & Kaiffer R. 1987. Remote Sensing and Image Interpretation. John Wiley & Sons.
3. Sabbins F. 1987. Remote Sensing Principle and Interpretation. Freeman

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