

**CIRCULAR NO.SU/ Sci. & Tech./Sub-Campus, Osmanabad/NEP/14/2023**

It is hereby inform to all concerned that, the syllabi prepared by the Departmental Committee and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted **the following curriculum of All Post Graduate Degree Courses as per Norms of National Education Policy - 2020 under the Faculty of Science & Technology run at University Department, Dr.Babasaheb Ambedkar Marathwada University, Sub-Campus, Osmanabad** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Syllabi of Deptt of BAMU, Sub Campus, Osmanabad.	Semester
1.	M.Sc. Chemistry specialization Analytical Chemistry, Organic Chemistry, Drug Chemistry.	Ist and IInd Semester
2.	M.Sc.Microbiology	Ist and IInd Semester
3.	M.Sc.Mathematics	Ist and IInd Semester
4.	M.Sc.Physics	Ist Semester
5.	M.Sc.Water & Land Management	Ist and IInd Semester

This is effective from the Academic Year 2023-24 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.

REF.NO.SU/NEP/2023/8541-49

Date:- 08.08.2023.

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

- 1] Head of the Department, All Departments, Dr.Babasaheb Ambedkar Marathwada University, Sub-Campus, Osmanabad.
- 2] The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.
- 2] The Section Officer,[M.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.
- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU,A'bad.
- 6] The Public Relation Officer, Dr.BAMU,A'bad.
- 7] The Record Keeper, Dr.BAMU,A'bad.

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
AURANGABAD,
SUB-CAMPUS OSMANABAD**



NAAC Reaccredited with 'A' Grade

**Department of Water and Land Management
(Autonomous)
Faculty of Science and Technology**

**2 Years Post-Graduate Programme
in
Water and Land Management**

**As per National Education Policy-2020
(To be implemented from Academic Year-2023-24)**

**Course Structure and Curriculum
(Outcome Based Credit System)**

**Subject: Water and Land Management
(Effective From 2023-2024)**


Head

Dept. of Water & Land Management
Dr. Babasaheb Ambedkar Marathwada University
Sub-Campus, Osmanabad



1. Mission:

Mission Statement

- To offer post-graduate and research program in Water and Land Management (WLM).
- To educate the society on WLM through research and extension program.
- To undertake research in the local area
- To develop the manpower for employment and self-employment in the domain of WLM.
- To provide practice based and value based teaching practices and facilities at department.
- To inculcate ethical and moral values and offering a robust support system, to inspire the youth for strengthening democracy.

2. Vision:

Vision Statement

- To develop the department into a centre of Excellence of international repute with infrastructure and facilities of international standards.
- To enrich quality education at post-graduate, doctoral and post-doctoral level through developing the teaching and research programmes in the subject and frontier areas of Water and Land Management with a view to supply highly qualified and trained technical personal.
- To cater the needs of industries, educational institutes and research organization, farming community, NGO'S, KVKS, Bank, Trusts having big land holding & Govt. departments.
- To offer quality consultancy and services to industries, educational and research organization in particular and society in general.

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3. Title of the Program (s):

Master of Science in Water and Land Management M.Sc. (WLM)

4. Program Educational Objectives:

The program educational objectives (PEO) are the statement that describes the career and professional achievement after the program of studies (graduation/ post-graduation). The PEO s are driven from question no. (ii) of the Mission statement (What is the purpose of organization).

- I. A competent professional in water and land management to solve the field base problem and provide appropriate solutions.
- II. An ability to start self-enterprise and or opt for employment in the field of water and land management.
- III. To opt for higher education, research and develop attitude towards life-long learning.
- IV. To provide value based and ethical leadership in the profession of water and land management as well as in society.

5. Program Outcomes:

The program outcomes (PO) are the statement of competencies/ abilities. POs are the statement that describes the knowledge and the abilities the graduate/ post-graduate will have by the end of program studies.

- I. The abilities to apply the knowledge and skill of principles and theories in water resources, soil, irrigation and management in the profession.
- II. Conduct survey and analyze the data.
- III. Identify appropriate water resources technique for optimal utilization of water and land.
- IV. Demonstrate/ ability to manage finance, irrigation plants and legal aspects in the profession.
- V. Use technology and techniques in the management of water and land resources.
- VI. To conduct research and evolve/identify the theories based on the research studies.
- VII. Implement water resources project for drinking water, irrigation, etc.
- VIII. Effective and higher level communication skill.
- IX. Demonstrate values and ethics in the managing the work and community.

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6. Eligibility:

Candidate has passed Bachelor's Degree Examination in Science with any subject, i.e. B.Sc. (Any Subject). Further, B.Sc.(Agriculture/Horticulture), B. Tech. , B.E. graduate students are eligible for M. Sc. (WLM).

7. Duration: Post-Graduate Diploma in Water and Land Management - 1 Year.

Post- Graduate Degree in Water and Land Management - 2 Years

8. Medium of Instruction: English

9. Attendance:

The students will not be allowed to appear for the examination if he/she do not attend minimum 75 % classes of theory, practical, project, etc.


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Course Structure for M.Sc. [Water & Land Management]

AS PER NEP 2020

Illustrative Credit distribution structure for Two Years/One Year Programme with Multiple Entry and Exit options –

(Discipline Specific Core in Water and Land Management)

Class: M.Sc. First Year

Semester: Ist Semester

Subject: Water and Land Management

Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
		Theory	Practical	Theory	Practical	
WLM/MJ/ 500T	Soil Science in Relation to Water & Plants	3	-	3	-	3+1+3+1+3+1+2=14
WLM/MJ/ 501T	Agro-Meteorology and Climate Change	3	-	3	-	
WLM/MJ/ 502T	Hydrology	3	-	3	-	
WLM/MJ/ 503T	Skills in Land Development (Survey & Levelling)	2	-	2	-	
WLM/MJ/ 500P	Soil Science in Relation to Water & Plants	-	2	-	1	
WLM/MJ/ 501P	Agro-Meteorology and Climate Change	-	2	-	1	
WLM/MJ/ 502P	Hydrology	-	2	-	1	3+1= 04
WLM/DE/ 504T A/ B/C	Land and Water Resource	3	-	3	-	
	Water Resources Development and Utilization Schemes	3	-	3	-	
	Natural Resources Management(Online)	3	-	3	-	
WLM/DE/ 504P A/B/C	Land and Water Resource	-	2	-	1	
	Water Resources Development and Utilization Schemes	-	2	-	1	
	Natural Resources Management	-	2	-	1	
Choose any one from A/B/C						
WLM/RM/ 505T	Research Methodology-1	4	-	4	-	04
		18	10	18	04	22 credits


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Class: M.Sc. First Year Semester: First Semester Subject: Water and Land Management

First Semester: *DSC-Based on specialisation

1. WLM/MJ/ 501T: Soil Science in Relation to Water & Plants
WLM/MJ/ 500P : Lab on Soil Science in Relation to Water & Plants
WLM/MJ/ 501T: Agro-Meteorology and Climate Change
WLM/MJ/ 501P: Lab on Agro-Meteorology and Climate Change
WLM/MJ/ 502T: Hydrology
WLM/MJ/ 502P : Lab on Hydrology
WLM/MJ/ 503T: Skills in Land Development (Survey & Levelling)
2. DSE—1,2 &3 (T/P): (Choose any one from Pool /Basket)
 1. WLM/DE/ 504 T+P A : Land and Water Resource
 2. WLM/DE/ 504T +P B : Water Resources Development and Utilization Schemes
 3. WLM/DE/ 504T+P C : Natural Resources Management (NPTEL)
3. WLM/RM/ 505T : Research Methodology-1


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Class: M.Sc. First Year Semester: II Semester Subject: Water and Land Management

	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
Course Code	Title	Theory	Practical	Theory	Practical	
WLM/MJ/ 550T	Advanced Techniques of Water Application	3	-	3	-	3+1+3+1+ 3 +1+2=14
WLM/MJ/ 551T	Organic Farming and Sustainable Agriculture	3	-	3	-	
WLM/MJ/ 552T	Water Conveyance & Distribution System	3	-	3	-	
WLM/MJ/ 553T	Skills in Water Measurement	2	-	2	-	
WLM/MJ/ 550P	Advanced Techniques of Water Application	-	2	-	1	
WLM/MJ/ 551P	Organic Farming and Sustainable Agriculture	-	2	-	1	
WLM/MJ/ 552P	Water Conveyance & Distribution System	-	2	-	1	
WLM/DE/ 554T A/B/C	Remote Sensing in Agriculture	3	-	3	-	3+1= 04
	Hydraulics	3	-	3	-	
	Farm Machinery	3	-	3	-	
WLM/DE/ 554P A / B /C	Remote Sensing in Agriculture	-	2	-	1	
	Hydraulics	-	2	-	1	
	Farm Machinery	-	2	-	1	
Choose any one from A/B/C						
WLM/OJT/ 555T	On the Job Training on Micro-irrigation/Field Project	4	-	4	-	04
		14	16	14	08	22 credits


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Class: M.Sc. First Year

Semester: Second Semester

**Subject: Water and Land
Management**

Second Semester: *DSC-Based on specialisation

1. WLM/MJ/ 550T: Advanced Techniques of Water Application
WLM/MJ/ 550P: Lab on Advanced Techniques of Water Application
WLM/MJ/ 551T: Organic Farming and Sustainable Agriculture
WLM/MJ/ 551P: Lab on Organic Farming and Sustainable Agriculture
WLM/MJ/ 552T: Water Conveyance & Distribution System
WLM/MJ/ 552P: Water Conveyance & Distribution System
WLM/MJ/ 553T: Skills in Water Measurement
2. DSE- 3&4 (T/P): (Choose any one from Pool /Basket)
 1. WLM/DE/ 554 A T+P Remote Sensing in Agriculture
 2. WLM/DE/ 554 B T+P Hydraulics
 3. WLM/DE/ 554 C T+P Farm Mechanization (NPTEL)
3. WLM/OJT/ 555T: On the Job Training/ Field Project


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Course Title:	SOIL SCIENCE IN RELATION TO WATER AND PLANTS			
Course Code:	WLM/MJ/500T	3 hrs/week	Credit:03	Semester-I

Learning Objectives:

1. To analyze the physical and chemical properties of soil in relation to the soil moisture constants.
2. To utilize the soil properties for scheduling the irrigation to the different crops.
3. To maximize the crop production by increasing the efficiency of irrigation method.
4. To test the soil fertility and determine the nutritional value contents in the soil.
5. To estimate the crop water requirement/ evapotranspiration of different crops for getting the maximum yield.

Syllabus: Theory

Unit I

Soil as a natural body, pedological and edaphological concepts of soil. Soil genesis: soil forming rocks and minerals. Weathering, processes, types and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil texture, structure, density surface area and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth

Unit II

Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids inorganic and organic; cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances-nature and properties; soil organisms: macro and microorganisms, their beneficial and harmful effects; Soil survey techniques, Soil profile, Soil irritability classification, Soils of Maharashtra and Problematic soils, Soil testing and fertility

Unit III

Soil water: Soil water classification, soil water retention, soil water potential, Water relations of soil, soil moisture constants, Hydraulic conductivity, permeability, percolation, movement and availability in soil, relationship between kinds of soil water and soil moisture constants. Water holding capacity of soil, submergence/drought/salt tolerance of crops, crop yield response to water, irrigation scheduling, methods of irrigation scheduling, Irrigation efficiencies, crop water use efficiency, crop water requirements, Root system of plants


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Course Code	WLM/MJ/500P	2 hrs/week	Credit:01	Semester-I
Course title	SOIL SCIENCE IN RELATION TO WATER AND PLANTS			

List of Practical

Experiment	Topic
1	Study of soil forming minerals.
2	Study of soil forming rocks.
3	Study of soil sampling tools, collection of representative soil sample, its Processing and storage.
4	Determination of moisture content in soil by gravimetric method.
5	Determination of soil colour by Munsell soil colour chart in field.
6	Determination of bulk density (Clod coating method) and particle density by Pycnometer and porosity of soil.
7	Determination of soil texture by feel method.
8	Determination of soil texture by Bouyoucos hydrometer method.
9	Determination of infiltration rate of soil by double ring infiltrometer
10	Determination of soil temperature by using soil thermometer (0-15 and 15-30cm).
11	Determination of soil Ph and electrical conductivity of soil.
12	Study of soil map.
13	Estimation of organic carbon and organic matter content in soil by Walkley and Black method.
14	Study of soil profile in field.

Reference Books:

1. Fundamentals of soil science published by Indian society of soil science. I.A.R.I. New Delhi. 110012.
2. Soil resources mapping of India by J.L. Sehgal (1991) NBSS & LUS Bulletin No. 25, Nagpur.
3. Second Maharashtra Water & Irrigation Commission-1999.
4. Crop water requirement, FAO, I & D, Pub. No.24 (Doorenbos & Pruitt)
5. Crop yield response to water, FAO I & D, Pub. No.33
6. Soil water, Hillel D. Academic Press Inc. New York.
7. Application of soil survey in irrigation management, WALMI Aurangabad pub. No. 21
8. Special course on D.A. of minor irrigation schemes, WALMI Aurangabad pub. No. 11
9. Das D.K.2011. Introductory Soil Science, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana.pp. 645.
10. Patil,V.D.and Mali, C.V.2007.Fundamentals of Soil Science, AmanPublication,Meerut
11. Jackson,M.L. 1973. Soil Chemical Analysis. PrinticeHall,India, Pvt. Ltd. New Delhi. pp498.
12. Piper, C.S.1966. Soil and Plant Analysis. Inters Science.Hans Publisher, Mumbai.

Course Title	Agro-meteorology and Climate change			
Course	WLM/MJ/501T	3 hrs/week	Credit: 03	Semester-I

Learning Objectives:

1. To study the earth's atmosphere and its composition
2. To study the elements of weather and its relation to agriculture
3. To assess the importance of Indian monsoon and its mechanism
4. To acquaint with artificial rainmaking, weather forecasting and meteorological phenomenon
5. To study the causes of climate change and its impact on regional and national Agriculture.

Theory: Syllabus

Unit I

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, longwave and thermal radiation, net radiation, albedo;

Unit II

Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, forms of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture,

Unit III

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 micro climate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.


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Practical

Course Title	Agro-meteorology and Climate change			
Course Code	WLM/MJ/501P	2hrs/week	Credit:01	Semester-I

Experiment	Topic
1	Visit of Agro meteorological Observatory.
2	Sites election of observatory, exposure of instruments and weather data recording.
3	Measurement of air temperatures, its tabulation and variation.
4	Measurement of soil temperature.
5	Measurement of rainfall.
6&7	Measurement of wind speed and wind direction.
8&9	Measurement of evaporation with the help of open pan evaporation.
10	Measurement of evapotranspiration.
11	Measurement of sunshine duration using Campbell Stokes sunshine recorder.
12	Measurement of solar radiation.
13	Measurement of Atmospheric pressure.
14	Measurement of Relative Humidity with the help of Assmann's psychrometer
15	Determination of Vapour pressure, R Handdewpoint temperature using hygrometric table
16	Preparation of Synoptic charts.
17	Study of Automatic Weather Station

ReferenceBooks:

1. Agricultural Meteorology- G. S. L. H. V. Prasad Rao, Kerala Agricultural University Publications.
2. Textbook of Agricultural Meteorology- M. C. Varshneya and P. Balkrishna Pillai.
3. Introduction to Agro-meteorology- H. S. Mavi
4. Our Atmosphere- Smita Bhutani
5. Atmosphere, weather and climate-Barry R. G. and Charley R. J.
6. Climate, weather and crops in India-D. Lenka.
7. Meteorology- S. R. Ghadekar


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Course Title	Hydrology			
Course Code	WLM/MJ/502T	3 hrs/week	Credit:03	Semester-I

Learning Objectives:

1. To explain the hydrological cycle, types and forms of precipitation and its measurement
2. To select the suitable method of runoff estimation and summarize the use of climatic model and forecasting techniques
3. To design and construct the water harvesting structures required in the state
4. To improve the hydrology of intercepted catchments and water availability indices

Syllabus: Theory

Unit I

Hydrology in water resources planning, rainfall, surface run off and sub-surface runoff as components of hydrologic cycle. Hydrological cycle: - Definition, Importance of hydrology, branches of Hydrology, Hydrological cycle. Precipitation: - Types & forms of precipitation, measurement of rainfall, methods of measurement of rainfall, types of rain gauges, Installation of rain gauge, rain gauge density. Runoff: - Definition, Their types, factors affecting runoff, methods of estimation of runoff, climatic model, forecasting techniques, relationship between precipitation and runoff.

Unit II

Water resources of Maharashtra State, water measurement, units of water measurement, Variability of Water Resources: - Water resources of state & country, Variability of water resources in State & Country. Water Harvesting: - Definition, History of development, principles, classification, water harvesting techniques used in various state water storage planning.

Unit III

Evaporation: - Evaporation losses from water bodies & surfaces, definition, instruments for measurement, factors affecting evaporation. Hydrology of intercepted catchments different types of catchments, water availability indices. Infiltration: - Definition, Terminology related to infiltration, measurement of infiltration, single cylinder infiltrometer, double cylinder infiltrometer, problems of infiltration. Flood routing, Reservoir sedimentation process.

Prof. H. D. Patil
Head

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Practical

Course Title	Hydrology				
Course Code	WLM/MJ/502P	2hrs/week	Credit:	01	Semester-I

List of Practical

S.No.	Topic	No. of Practicals
1	Delineation of watershed and study of watershed characteristics	1
2	Measurement of rainfall and runoff in a watershed	1
3	Analysis of hydrologic data and flow from small watersheds	1
4	Estimation of infiltration and runoff from a watershed	1
5	Measurement and analysis of stream flow data	1
6	Use of runoff estimation models: SCS, CN methods	1
7	Study of different types of flood routing methods	1
8	Study of reservoir sedimentation	1
9	Study of watershed model components	1
10	Visit to a watershed	1
	Total	10

Suggested Readings:

1. Singh, V.P. 2010. Rainfall-Runoff Modeling (Vol.I) Prentice Hall, New York.
2. Singh, V.P. 2010. Environmental Hydrology, Springer, New York.
3. Haan, C. T. Hydrologic Modeling of Small Watershed.
4. Mutreja, K. N. Applied Hydrology Tata Mc Grow Hill publishing company Limited, New York.
5. Subramanya, K. Engineering Hydrology. Tata Mc Grow Hill Publishing company Limited, Second edition.
6. Suresh, R. Soil and Water Conservation Engineering. Standard publishers distributors, 5th edition,
7. VenTe chow, David R Maukment, Larry w Mays (2010). Applied Hydrology TATA Mc Grow Hill edition.
8. Hoshin Vijai Gupta and Soroosh Sorooshian (1998). Towards improved calibration of hydrologic models: Multiple and non-common surable measures of information. Water Resources Research, VOL. 34, NO. 4, PAGES: 751-763,



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Course Title	Skills in Land Measurement			
Course Code	WLM/MJ/503T	2 hrs/week	Credit:02	Semester-I

Learning Objectives:

1. To classify the methods of surveying, traversing and leveling.
2. To explain the bearings, angles and graphical methods of compass traversing
3. To develop contours, study characteristics of contours and interpolation of contours.
4. To design a map by using plane table, theodolite and other survey instruments.
5. To interpret the importance of remote sensing techniques and apply the remote sensing in water and land management.

Syllabus:Theory:

Unit I

Chain & ranging: Classification and Principles of surveying, Precision in surveying, chain and tape, Direct and indirect ranging, chaining a line, Errors in chaining, Tape correction Offsets, Cross staff survey,

Compass Traversing: Prismatic and Surveyor's compass. Meridians, True, Magnetic and Arbitrary bearings, Fore and back bearing, calculations of angles from bearings and bearings for angles. Local attraction and correction of bearings. Traversing with the chain and compass, Graphical method of compass traverse adjustment.

Unit II

Leveling: Dumpy level, Auto level, Temporary and Permanent adjustment, Bench Marks, Reduction of levels, Profile leveling, Reciprocal leveling, check leveling, Plotting of profiles, Contouring, Characteristic of contour lines and their use, Method of contouring, interpolation of contours.

Plane Table Survey: Accessories and adjustments of plane table, Methods of plane tabling and their suitability, Storage.

Theodolite: Construction, Temporary and permanent adjustments

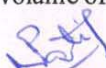
Unit III

Measurements of horizontal angles and vertical angles by various methods.

Remote sensing: Introduction, applications land management and color code, Indian satellite data. Global Positioning system (GPS)

Practical

1. Scale, Symbols on maps; plan elevation, isometric view.
2. Measurement of land slopes, river gradients.
3. Computation of Areas and Earth Work: Planimeter-Theory and use, Area of cross sections for level, two level, three level, side hill two level and multilevel section, Prismoidal and trapezoidal formula for volume calculations, Prismoidal correction, volume of cut and fills, haulage and lifts, mass diagrams for economic grade line.
4. Presentation of climatic data on maps.


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5. Drawing of contour maps.

Readings:

1. Surveying and leveling Vol. I & II by Prof. T.P. Kanetkar & Prof. S.V. Kulkarni.
2. Surveying Vol. I & II by Dr. B.C. Punmia., Laxmi Publications Pvt. Ltd. New Delhi.
3. Surveying and leveling by Basak
4. Remote Sensing by Kiefer


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Course Title	Land and Water Resources			
Course:	WLM/DE/504T+P	Credit:	4(3+1)	Semester-I

Water and Land Resources

Course Outcomes:

1. To describe the significance of water and land resources with special reference to natural resource management,
2. To describe with agro climatic zones of Maharashtra and India and agro regionalization.
3. To analyze the diversion schemes and storage schemes

Syllabus: Theory:

1. Agro climatic zones of India and Maharashtra, Importance of Agro regionalization.
2. Water wealth availability, Statistics, surface and ground water resources,
3. Definition of soils, types of soil, soil fertility, soil productivity, Land occurrence and their present status, drought, types of droughts, effects of droughts.
4. Brief history of water resources development
 - A) Indian
 - B) Global
5. Present Status of surface rivers & Dams in Maharashtra, ground water of Maharashtra

Readings:

1. Social & organizational aspects of irrigation management, WALMI Aurangabad Pub. No. 52.
2. Education & Communications for development by Danama&Bhatnagar, Oxford & IBH Pub. New Delhi.
3. Rural Sociology by Desai A.R.
4. Blue Revolution by Dr. Madhavrao Chitale
5. Dying Wisdom
6. C.W.C.-Corrigendum on Water Statistics


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Course Title	Water Resources Development and Utilization Schemes			
Course Code	WLM/DE/504T+P	Credit:	4(3+1)	Semester-I

Learning Objectives:

1. To discover the biotic approach of environment management
2. To explain the Kautilyan management of water and land resource and thereby making the students capable of working in an agricultural sector.
3. To create awareness about the limited natural resources and make them able to manage judiciously

Syllabus: Theory:

UNIT I

Traditional schemes: Practices of Water Resources Development & utilization

- A. Kautilian management of Community Water Development & Utilization, Sholakes on water indicators.
- B. Location of Ground Water: Biotic Approach of Environment Management in general & Water Management in Particular

UNIT II

Types of schemes: Modern Concepts, classification of irrigation projects.

- A. Storage Schemes - Types of dams & their components, their allocation, Operation & Maintenance of storage schemes- Monitoring & Evaluation
- B. Diversion Schemes- Purpose, Types, Suitability, Operation & Maintenance
- C. Monitoring & Evaluation

UNIT III

Variability of natural resources [Part-I & Part-II]

- A. Part-I Chak Planning, Field Channel & Structures on it
- B. Part-II Land smoothening, Land Grading & Land Leveling& Implements used

Readings:

1. Irrigation theory & practices by A. M. Michael
2. Water Supply & Sanitary Engineering by S. C. Rangwala
3. Water Power Engineering by SantoshkumarGarg
4. Agronomy- J. Sahay
5. WALMI- Pub. No. 1.
6. WALMI- Pub. No. 36.
7. Operation & Management of Irrigation systems in Maharashtra, WALMI Aurangabad pub. No. 20
8. Water Distribution Practices in Maharashtra, WALMI, Aurangabad pub. No. 22
9. KautilyaArthashashtra – by Dr. Kangle
10. KautiliyaArthashashtra – SarotaPrakashan


 Head
 Dept. of Water & Land Management
 Dr. Babasaheb Ambedkar Marathwada University
 Sub-Campus, Osmanabad

Course title:	Natural Resource Management (NPTEL)			
Course Code:	WLMC TH 1011	Credit:	4(3+1)	Semester-I

Learning Objectives:

1. To focus on the need of sustainable management of the Earth's depleting natural resources
2. To provide students with a wider perspective on many national and international natural resources management (NRM) issues.
3. To acquaint the students with farm based technologies and simulation modeling
4. To develop the skills of PRA and RRA among the students
5. To study the Environment Management system

ABOUT THE COURSE:

This course focuses on the need of sustainable management of the Earth's depleting natural resources such as soil, water, forest, minerals and biological resources, in relation to the growth of the human population. The range of topics covered in the course will provide students with a wider perspective on many national and international natural resources management (NRM) issues. Farm based technologies and simulation modeling is an important aspect of modern day NRM. Appropriate NRM is the key to the sustainable development.

INTENDED AUDIENCE: under graduate and post graduate students, professional, practitioner in the discipline of Agriculture, Rural Technology, Rural Development, Agricultural Engineering, Environmental Science, Environmental Study, Ecology, Natural Resources Management etc.

PREREQUISITES: Bachelor Degree in any Engineering and/ or Science discipline.

INDUSTRY SUPPORT: Industries dealing with land restoration, biomedicine development, irrigation, forest product utilities, Agricultural technologies, Landscape management, Air management etc.

Week 1: Introduction to Natural Bases: Part 1

Week 2: Introduction to Natural Bases: Part 2

Week 3: Resource Management Paradigms: Part 1

Week 4: Resource Management Paradigms: Part 2

Week 5: Approaches in Resource Management

Week 6: Biodiversity and conservation of natural resources

Week 7: Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA): Part 1

Week 8: Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA): Part 2

Week 9: Technologies for NRM

Week 10: Community Based Natural Resources Management

Week 11: Environmental Management Systems (EMS)

Week 12: Modeling tools and ICT for NRM

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Books and references:

1. D.R. Lynch, Sustainable Natural Resource Management: For Scientists and Engineers, Publisher: Cambridge University Press, 2009.
2. M. C. Dash, Concepts of Environmental Management for Sustainable Development Publisher: I K International Publishing House Pvt. Ltd., 2013.



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Sub-Campus, Osmanabad

Course Title	Research Methodology (RM-1)			
Course:	WLM/RM/505T	Credit:	4	Semester-I

COURSE OUTCOMES

1. To apply the various research and scientific methods with reference to water and land management
 2. To define and identify the research problems
 3. To develop the technique involved in defining the problems.
 4. To explain the importance of research design, features of good design
 5. To test the hypothesis
-
1. Introduction: Meaning of Research, Types of Research, Research & scientific methods with references to water & Land Management & Agricultural & Marketing.
 2. Defining the research problems, Identification of Research problems, Technique involved in defining the problems
 3. Research design: Meaning and need of research design, features of a good design, important concepts relating to research design.
 4. Sampling designing, Census and sample survey, steps in sample design, Different types of sample designs.
 5. Testing of hypothesis.
 6. Collection of data, classification of data, measure of central tendency, measure of dispersion.

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Sub-Campus, Osmanabad

Course Title	ADVANCE TECHNIQUES IN WATER APPLICATION		
Course Code	WLM/MJ/550T	Credit: 03	Semester-II

Learning Objectives:

1. To explain the concept, types, merits, demerits, management of greenhouse.
2. To apply the greenhouse technology for maximization of valuable agricultural produce.
3. To make use of advanced techniques for achieving maximum irrigation efficiencies.
4. To design drip irrigation and sprinkler irrigation based on the soil characteristics, water availability and crop water requirement.
5. To explain the government policies and incentives to promote analyze advanced techniques in irrigation.

Syllabus: Theory

1. Greenhouse Technology: Introduction, Types, merits, demerits Management of Greenhouse, Installation & Operation.
2. Drip Irrigation: Advantages, Introduction, Merits and Demerits, Types, Components of drip irrigation systems along-with their details including classification, types, specifications, construction setc. Components, their types, planning & Design.
3. Layout and evaluation of micro irrigation systems inrelation to source, soil, climate and topographical conditions. Selection of pipesize, pumpsandpowerunits.
4. Sprinkler Irrigation: Introduction, Types, Merits & Demerits, and planning & Design. (Concepts & use of ready reckoners for selection & estimation)
5. Irrigation scheduling of drip and sprinkler irrigation systems based on weather and soil moisture concepts. Software for irrigation scheduling: CROPWAT, AQUACROP, Phule Jal and Phule Irrigation Scheduler
6. Fertigation through sprinkler and micro irrigation systems. Fertigation techniques used in drip and sprinkler irrigation systems, Fertigation scheduling software: Phule Fertigation Scheduler. Other micro-irrigationsystems:micro-sprinkler and bubblerirrigation systems.
7. Govt. Policies & incentives to promote Advance techniques in irrigation.


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Course Title	ADVANCE TECHNIQUES IN WATER APPLICATION		
Course Code	WLM/MJ/550P	Credit: 01	Semester-II

Practical:

1. Design of drip and sprinkler irrigation system for various crops.
2. Calculation of total head.
3. Evaluation of drip and sprinkler irrigation systems.
4. Software for irrigation scheduling and design of drip and sprinkler irrigation systems.
5. Calculation of cost benefits of drip and sprinkler irrigation system.

Readings:

1. Drip Irrigation by Holsambre D.G.
2. ICID handbooks
3. Drip Irrigations by Shivappan
4. Greenhouse Technology
5. Jensen M E. (Editor). 1983. *Design and Operation of Farm Irrigation Systems*. A S A E, Monograph No. 3. U S A.
6. James L G. 1988. *Principles of Farm Irrigation System Design*. John Wiley and Sons, New York, U S A.
7. CROPWAT: <https://www.fao.org/land-water/databases-and-software/cropwat/en/>
8. AQUACROP: <https://www.fao.org/aquacrop/en/>
9. Phule Jal: https://mpkv.ac.in/Uploads/MpkvProduct/Phule%20%20Unit_20191127034252.pdf



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Course Title	ORGANIC FARMING AND SUSTAINABLE AGRICULTURE		
Course Code	WLM/MJ/551T	Credit: 03	Semester-II

Learning Objectives:

1. To explain the concept of organic farming, its principles and scope.
2. To apply the Concept of sustainability in cropping systems and farming systems
3. To make use of organic inputs for getting the residue free crop production. Certification process and standards of organic farming,
4. To study the Integrated farming system model for rainfed and irrigated conditions.
5. To explain the government policies and incentives to promote organic agriculture

Syllabus: Theory

Unit I

Organic farming, principles and its scope in India; Initiatives taken by central and state government, NGOs and other organizations for promotion of Organic agriculture, organic ecosystem and their concepts, Choice of crops and varieties in organic farming, Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use. i.e Land equivalent ratio (LER) Mechanism of yield Assessment of yield advantages.

UNIT II

Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under mono culture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, Integrated farming system model for rainfed and irrigated conditions. Mechanism of yield advantage in inter cropping systems.

UNIT III

Above and below ground interactions; competition relations; multi storied cropping and yield stability in inter cropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture. Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concepts of fertilizer use in intensive cropping system. Operational structure of NPOP, Certification process and standards of organic farming, economic considerations and viability, marketing and export potential of organic products.



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Course Title	ORGANIC FARMING AND SUSTAINABLE AGRICULTURE		
Course Code	WLM/MJ/551P	Credit: 01	Semester-II

Practical

Sr.No.	Practical
1-2	To study the yield advantages in inter cropping system
3-4	Visit to Organic farm to study the various components and their utilization
5-6	To study the preparation methods of vermicompost and vermiwash
7-8	To study the cropping system in sustainable agriculture
9-10	Study of indigenous technology knowledge (ITK) for nutrient, insect, disease and weed management
11-12	To study the field experiments relevant to the cropping systems and Integrated farming system models.
13-14	To study the method of preparation of Dshparni, Neem seed extract in Organic farming
15-18	Visit to biocontrol Laboratory, biofertilizer and vermicompost unit

Suggested Books:

1. Organic Farming for Sustainable Agriculture by Dahama A.K. Agrobios Publication.
2. Organic Farming: Theory and Practices by Palanippan, S.P. and Anadurai, K.
3. Organic Farming in India, Problems and Prospects by Thapa, U. and Tripathi, P.
4. Trends in Organic Farming in India by Agrobios Publication
5. Handbook of Organic Farming.
6. Recent Developments in Organic farming by Gulati and Barik
7. Singh S S. 2006. Principles and Practices of Agronomy. Kalyani.


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Course Title	WATER CONVEYANCE & DISTRIBUTION SYSTEM		
Course Code	WLM/MJ/552 T	Credit: 03	Semester-II

Learning Objectives:

1. To implement/suggest water conveying equipments in canal networks.
2. To explain and classify water lifting devices
3. To distinguish traditional and modern water conveyance systems traditional and modern methods of irrigation.
4. To infuse the knowledge about different types of channel flow and their behavior
5. to gain the knowledge of appraisal of flow control and distribution structures including design of stable channel

Syllabus: Theory

Unit-I

Channel characteristics. Prismatic and non-prismatic channel. Steady, unsteady, uniform and non-uniform flow. Open channel and their properties. Energy and momentum, critical flow computation and application. Basic Concepts of free surface flow, classification of flow, velocity and pressure distribution.

Unit-II

Uniform flow, conservation law sand specific energy. Application of momentum and energy equation. Channel transition. Study of critical flow, uniform flow, gradually varied flow, rapid varied flow, spatially varied flow and unsteady flow and their computations.

Energy dissipation. Flow control structures and flow measurement. Theories and methods of open channel design. Sediment transporting channels. Regime flow theories. Tractive force theory. Design of stable channels.

Unit-III

Basic principles of pipe flow, pipe flow problems and equivalent pipe. Principles of network synthesis. Pipe network analysis. Water transmission lines. Cost considerations: Single-Input source. Branched systems: Single-Input source. Looped Systems: Multi-Input source. Branched systems: Multi-Input source, Looped systems. Decomposition of a large water system and optimal zone size.


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Course Title	WATER CONVEYANCE & DISTRIBUTION SYSTEM		
Course Code	WLM/MJ/552 P	Credit: 01	Semester-II

List of Practicals

Sr. No.	Topic	No. of Practicals
1.	Computation and use of geometrical and hydraulic elements Of open channel	2
2.	Study of Flow measuring devices, methods and their limitations	2
3.	Examination of velocity distribution	2
4.	Calculation of energy and momentum coefficients	2
5.	Channel design: problems and its solution	3
6.	Appraisal of flow control and distribution structures	2
7.	Analysis and computation of flow profiles	3
	Total	16

I. Suggested Reading

- Chaudhry M H. 1993. *Open Channel Flow*. Prentice-Hall, N J.
- Chow V T. 1979. *Open Channel Hydraulics*. Mc Graw Hill Inc. N York.
- French R H. 1986. *Open Channel Hydraulics*. Mc Graw Hill Pub Co., N York
- Henderson F M. 1966. *Open Channel Flow*. Macmillan Co. New York.
- Prabhata K Swamee and Ashok K Sharma. *Design of Water Supply Pipe Networks*. John Wiley New York.
- Subramanya K. 2008. *Flow in Open Channels*. Tata Mc Graw Hill Pub.
- Terry Sturm. 2011. *Open Channel Hydraulics*. Tata Mc Graw Hill Pub.

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Course Title	SKILLS IN WATER MEASUREMENT				
Course	WLM/MJ/553T	2 hrs/week	Credit:	02	Semester-II

Learning Objectives:

1. To demonstrate the water measuring devices and experiment with the flow through v-notch, flumes and orifice.
2. To solve the problems related to water pressure and pressure head.
3. To measure the flow in open channel, close conduits

Syllabus: Theory

UNIT I

Units of Measurement of Water, Methods of water measurement; Volume method of water measurement, Velocity-Area methods, Flow through pipelines

UNIT II

Weirs and flumes:

Weirs: Rectangular weirs, V notch weirs, General requirements for the setting and operations of weirs, Limitations in the use of weirs Parshall Measuring flume, Cut throat flume, submerged flow analysis

UNIT III

Water Measurement structures for varying flows in Earthen Channels

1. Broad Crested Rectangular Weirs
2. Truncated flumes
3. Triangular throated flumes
4. Portable flumes for earthen channels

Orifices and meter gates: Free flow orifices, submerged orifices, Meter gates

Reference Books:

1. Irrigation theory & practices by A. M. Michael
2. Land Management by VVN Murthy

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Course Title	REMOTE SENSING IN AGRICULTURE			
Course Code	WLM/DE/554T	3 hrs/week	Credit : 03	Semester-II

Learning Objectives:

1. To study the basic principles and components of remote sensing
2. To study the Digital techniques for crop discrimination and identification
3. To develop the skills of the students in land use/land cover mapping and planning; integrated watershed development
4. To aware the students about GIS and remote sensing for land and water resources

Syllabus: Theory

UNIT I

Basic principles of remote sensing. Components of remote sensing: signals, sensors and sensing systems: active and passive remote sensing; Electromagnetic spectrum, characteristics of electromagnetic radiation, Energy interaction with matter; spectral features of earth's surface features. Introduction to Geographical Information System (GIS) and GPS.

UNIT II

Imaging and non-imaging systems; framing and scanning systems; resolution of sensors; sensors platforms, their launching and maintenance; data acquisition system, data preprocessing, storage and dissemination. Digital image processing and information extraction; microwave remote sensing; visual and digital image interpretation; Digital techniques for crop discrimination and identification; crop stress detection.

UNIT III

GIS and remote sensing for land and water resources data collection, inventory of ground water and satellite measurement of surface soil moisture and temperature; drought monitoring, monitoring of crop disease and pest infestation; soil resource inventory; land use/land cover mapping and planning; integrated watershed development; crop yield modeling and crop production forecasting.


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Practical:

Course Title	REMOTE SENSING IN AGRICULTURE			
Course Code	WLM/DE/554P	3 hrs/week	Credit : 01	Semester-II

Sr.No.	Topic
1-2	Interpretation of Aerial photographs for mapping
3-4	Interpretation of satellite image for mapping
5-6	Study of image processing software
7-8	Study of image enhancement; image classification methods
9-10	Familiarization with remote sensing and GIS hardware, software and the principle of working
11-12	Comparison between ground truth and remotely sensed data
13-14	Study of GIS package
15-16	Use of GIS package for Crop acre age estimations
17-18	Use of GIS package for water resources assessment

Suggested Readings:

1. Colwell, R. N. (editor). Manual of Remote Sensing- Vol. I & II, Am Soc. Photogrammetry, Virginia. Curran, P. J. Principles of Remote sensing, ELBS/Longman.
2. Jain, A. K. 1989. Fundamentals of Digital Image Processing, Prentice Hall of India,
3. Saddle river, N. J., Kamat, D.S. and Sinha, S.K. (Eds) 1984. Proceedings of the Seminar on Crop Growth Condition and Remote Sensing, June22-23, ICAR & ISRO.
4. Lilles T. M. and Kiffer, R.W. Remote Sensing and image interpretation, John Wiley & sons.
5. Majumdar, K. L. et. al. 1983. Selection of spectral band sand their widths for the Indian Remote Sensing satellite (IRS), R S P-1P/TN03/83,Space Applications Centre, Ahmedabad-380053.
6. Sabins, F. F. 1997. Remote Sensing- Principles and Interpretation, 3rded. W. H. Freeman
7. DeMess M. N. 2004. Fundamental of Geographic Information System. John Wiley & Sons.

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Course Title	HYDRAULICS		
Course	WLM/DE/554T	Credit: 03	Semester-II

Learning Objectives:

1. To define the concept of hydraulics, and related terminology
2. To describe the concept of energy, its types and numerical on energy.
3. To design open channel flow using daray's equation, morning's equation and chezy's constant.
4. To demonstrate the water measuring devices and experiment with the flow through v-notch, flumes and orifice.

Syllabus: Theory:

1. Hydraulics- Definition, Characteristics, Terminology, Device-Problems on That Q through devices, V-Notch flumes orifice weir, Energy Concept- Types of energy & Problems on energy.
2. Pipe flow- Concepts, friction loss- types of frictions losses, problems on friction loss, discharge calculation.
3. Water pressure-problems on water pressure.
4. Types of flows, Differentiate between closed conduits & open channel.
5. Problems on open channel design- Darcy's equation, Manning's equation, Chezy's constant.

Experiments:

- 1) Measurement of flow characteristics
- 2) Measurement of static pressure

Readings

1. Open Channel hydraulics by Ven. T. Chou.
2. Flow Measurement in irrigation canals WALMI, Aurangabad (Pub.No.36)
3. Flow through pipes by Sethi & Lal.



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Course Title	Farm Machinery (NPTEL)				
Course Code	WLM/DE/554T+P		Credit:	4(3+1)	Semester-II

Learning Objectives:

1. To study the basic principles and use of modern technology in agriculture
2. To design the horticulture machines and equipments
3. To study the various machines used in farm, custom hiring and mechanization of small farms
4. To study the machinery for land drainage, reclamation and estate maintenance and equipment for irrigation.

Farm Machinery

By Prof V. K. Tewari | IIT Kharagpur

ABOUT THE COURSE:

The course on Farm Machinery is designed for undergraduate students of Agricultural Engineering, Practicing Engineers, Machinery Manufacturers and Research Scientists. The contents comprises of basic principles and the use of modern technology, viz, Image Processing, Microcontrollers, Sensors and Embedded Systems. Design of horticultural machines and equipment are specially included considering the need of the hour. Suitable examples in the form of problems and their solutions are included for the students to get clarity about the various concepts discussed on each topic. Use of machines Custom hiring and mechanization of small farms are also discussed under each level of mechanization for the readership to appreciate the importance of the machines used.

Course layout

Week 1 : Importance of farm machines in the contest of enhance production, multiple cropping, labour scarcity etc.

Week 2 : Ploughing and first opening of the soil, the design and component details.

Week 3 : Machinery of seedbed preparation operation.

Week 4 : Equipment for sowing and planting and inter cultivation.

Week 5 : Variable Rate Fertilizer Applicator, Microprocessor Based Herbicide Applicator, Spraying etc.

Week 6: Equipment for irrigation

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Week 7 : Machinery for crop harvesting design and operation

Week 8 : Root crop harvesting machinery

Week 9 : Machinery for horticultural crops

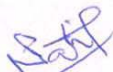
Week 10 : Equipment for crop protection and disease control

Week 11 : Machinery for transport and material handling

Week 12 : Machinery for land drainage, reclamation and estate maintenance

Books and references

1. Principles of Farm machinery – Robert Allen Kepner, Roy Bainer, Edgar Lee Barger
2. Principles of Agricultural Engineering – Ojha & Michael
3. Farm Machinery - Claude Culpin


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