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**[OBE DESIGN- WATER & LAND
MANAGEMENT DEPARTMENT]**

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PREFACE

Outcome Based Education (OBE) is the educational approach which focuses on student centric education in the context of development of personal, social, professional and knowledge (KSA) requirements in one's career and life. It is the decade ago curriculum development methodology. The educational triangle of LEARNING-ASSESSMENT-TEACHING is the unique nature of the OBE approach. The curriculum practices such as Competency Based Curriculum, Taylor's Model of Curriculum Development, Spadys' Curriculum principles, Blooms taxonomy and further use of assessment methodologies like, Norm-reference testing and Criterion reference testing, etc is being practiced since decades. It is also interesting to know that, globally, different countries and universities adopts the curriculum development models/approaches such as, CDIO (Conceive-Design-Implement-Operate), Evidenced Based Education, Systems' Approach, etc as the scientific and systematic approaches in curriculum design.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) in-lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university.

This document is the outcome of different meetings and workshops held at university level and department level. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of OBE. This is the first step towards the implementation of OBE in the department. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the graduates/Post-graduates of the university department.

Head of Department

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OUTCOME BASED EDUCATION

Faculty of Commerce and Management Science

Department of Water and land Management

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.

2. Vision:

Vision Statement

- To develop the department into a centre of Excellence of international repute with infrastructure and facilities of international standards.
- To offer high quality post-graduate, doctoral and post doctoral degree 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.

3. Title of the Program (s):

- a. Master of Water and Land Management

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 PEOs 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 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.

- a. The abilities to apply the knowledge and skill of principles and theories in water resources, soil, irrigation and management in the profession.
- b. Conduct survey and analyze the data.
- c. Identify appropriate water resources technique for optimal utilization of water and land.
- d. Demonstrate/ ability to manage finance, irrigation plants and legal aspects in the profession.
- e. Use technology and techniques in the management of water and land resources.
- f. To conduct research and evolve/identify the theories based on the research studies.
- g. Implement water resources project for drinking water, irrigation, etc.
- h. Effective and higher level communication skill.
- i. Demonstrate values and ethics in the managing the work and community.

6. Course- Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricular-extra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, *“to which POs his/her course in*

contributing?. So that one can design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Course-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between the courses and program outcomes. The CO-PO matrix is the map of list of courses contributing to the development of respective POs.

The CO-PO matrix is provided in the below table.

WATER AND LAND MANAGEMENT INSTITUTE

Course Title	a	b	c	d	e	f	g	h	i
Water and land Resources	*		*						
Practical	*		*						
Survey, leveling and mapping	*	*			*		*		
Practical	*	*			*		*		
Soil science in relation to water & plant	*		*			*			
Practical	*		*			*			
Computational techniques		*			*	*			
Practical		*			*	*			
Constitution of India				*				*	*
Hydrology	*		*						
Practical	*		*						

Advance techniques in water application	*		*	*	*				
Practical	*		*	*	*				
Agricultural entrepreneurship				*				*	*
Legal aspects of WRM				*				*	*
Financial management	*		*	*	*				
Research methodology				*	*	*	*	*	*
Integrated Water shade management		*	*	*	*				
Practical		*	*	*	*				
Management of irrigated plants	*		*	*	*				
Management skills		*	*	*	*	*		*	*
Research Methodology				*	*	*	*	*	*
Seminar				*			*	*	
Optimization techniques	*	*	*	*	*	*	*		
Practical	*	*	*	*	*	*	*		

Service course				*			*	*	
Ground water management	*		*	*	*				
Practical	*		*	*	*				
Managerial perspective	*		*	*	*				
Dissertation				*	*	*	*	*	*
Drinking water management	*		*	*	*				
Practical	*		*	*	*				

7. Course Outcomes (for all courses):

The course outcomes are the statement that describes the knowledge & abilities developed in the student by the end of course (subject) teaching. The focus is on development of abilities rather than mere content. There can be 5 to 7 course outcomes of any course. These are to be written in the specific terms and not in general. The list of course outcomes are the part of Annexure-B attached herewith.

8. Set Target levels for Attainment of Course Outcomes:

The course outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment are measured/calculated. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

The set target level is either decided by the department/course coordinator or it can be set w.r.t. the passing % trend for the respective course.

9. Set Target level for Attainment of Program Outcomes:

The program outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies.

In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment and program outcome attainment is measured/calculated. The program outcome attainment is governed by curricular, co-curricular and extra-curricular activities including the stakeholders' participation. The direct method and indirect method is adopted to calculate the PO attainment. The direct method implies the attainment by course outcomes contributing to respective program outcomes. And indirect method is the satisfaction/feed-back survey of stakeholders. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

The set target level is the set benchmark to ensure the continuous improvements in the learners/ graduates' performance.

10. Course Attainment Levels:

- a. CO attainment is defined/set at three levels;
- b. The CO attainment is based on end term examination assessment and internal assessment;
- c. The Co attainment is defined at three levels in ascending order-
 - i. e.g. For end term and internal examination;
 - ii. Level-1: 30% students scored more than class average
 - iii. Level-2: 40% students score more than class average;
 - iv. Level-3: 50% students score more than class average.
- d. The target level is set (e.g. Level-2). It indicates that, the current target is level-2; 40% students score more than class average. The CO attainment is measured and the results are obtained. Based on the results of attainment, the corrective measures/remedial action are taken.
- e. CO Attainment= 80% (Attainment level in end term examination) + 20% (Attainment level in internal examination).

11. Program attainment Level:

- a. PO attainment is defined at five levels in ascending order;
- b. The PO attainment is based on the average attainment level of corresponding courses (Direct Method) and feed-back survey (Indirect method);
- c. The PO attainment levels are defined / set as stated below;
 - i. Level-1: Greater than 0.5 and less than 1.0 (0.5>1)- Poor
 - ii. Level-2: 1.0>1.5-Average
 - iii. Level-3: 1.5>2.0-Good
 - iv. Level-4: 2.0>2.5-Very Good
 - v. Level-5: 2.5>3.0 -Excellent
- d. The PO attainment target level is set/defined (say, Level-4). It implies that, the department is aiming at minimum level-4 (very good) in the performance of abilities by the graduates. Based upon the results of attainment, the remedial measures are taken;

- e. PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

12. The Results of CO Attainment:

The Results of Co attainment are provided in Annexure-C

Example:

- e.g. For end term and internal examination;
- i. Level-1: 30% students scored more than class average
 - ii. Level-2: 40% students score more than class average;
 - iii. Level-3: 50% students score more than class average.
 - iv. The set target level is , Level-2

For the course, WLM-111,

50% students score more than class average in internal and external examination i.e. Level-3

$$A(\text{CO}) \text{ WLM-111} = 80\% (3) + 20\%(3)$$

$$= 2.4 + 0.6$$

$$= 3.0 \text{ i.e. Level-3}$$

Conclusion: The target level is fully attained

Table No. 1.0: CO Attainment Level

Course Title	CO Attainment Value	CO Attainment Target Level	Attainment Yes/No	Remedial Measures for Non-attainment
Water and land Resources	3	2	Fully Attained	
Practical	2	2	Fully Attained	
Survey, leveling and mapping	2	2	Fully Attained	
Practical	3	2	Fully Attained	

Soil science in relation to water & plant	3	2	Fully Attained	
Practical	3	2	Fully Attained	
Computational techniques	3	2	Fully Attained	
Practical	2	2	Fully Attained	
Constitution of India	2	2	Fully Attained	
Hydrology	3	2	Fully Attained	
Practical	2	2	Fully Attained	
Advance techniques in water application	1	2	Not Attained	Assignments, Exercise, Tutorials, remedial Coaching
Practical	3	2	Fully Attained	
Agricultural entrepreneurship	1	2	Not Attained	Assignments, Exercise, Tutorials, remedial Coaching
Legal aspects of WRM	3	2	Fully Attained	
Research methodology	3	2	Fully Attained	
Financial management	1	2	Not Attained	Assignments, Exercise, Tutorials, remedial Coaching

Integrated Water shade management	2	2	Fully Attained	
Practical	3	2	Fully Attained	
Management of irrigated plants	2	2	Fully Attained	
Practical	2	2	Fully Attained	
Management skills	2	2	Fully Attained	
Research Methodology	3	2	Fully Attained	
Seminar	3	2	Fully Attained	
Optimization techniques	3	2	Fully Attained	
Practical	3	2	Fully Attained	
Service course	1	2	Not Attained	Assignments, Exercise, Tutorials, remedial Coaching
Ground water management	3	2	Fully Attained	
Practical	3	2	Fully Attained	
Managerial perspective	3	2	Fully Attained	
Dissertation	3	2	Fully Attained	

Drinking water management	3	2	Fully Attained	
Practical	3	2	Fully Attained	

13. The Results of PO Attainment:

The Results of PO attainment are provided in Annexure-C

The PO attainment levels are defined / set as stated below;

- i. Level-1: Greater than 0.5 and less than 1.0 (0.5>1)- Poor
- ii. Level-2: 1.0>1.5-Average
- iii. Level-3: 1.5>2.0-Good
- iv. Level-4: 2.0>2.5-Very Good
- v. Level-5: 2.5>3.0 -Excellent

The PO attainment target level is set/defined (say, Level-4).

For Example: The attainment of PO (c) is calculated by using the methodology stated in point No. 11 above.

PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

$$A(\text{ PO) } c = (3+2+3+3+3+2+1+3+1+2+3+2+2+2+3+3+3+3+3+3)/21 + 20\% (\text{feed-back})$$

$$= 80\% (2.52381) + 20\% (2.5)$$

$$= 2.02 + 0.5$$

$$= 2.52 \text{ i.e. Level-5} \longrightarrow \text{It implies that, the attainment of PO is fully attained.}$$

Table No. 2.0 PO Attainment Level

PO/PSO number	PO Attainment Value	Target Attainment level	Fully attained/ Not Attained	Remedial Measures
a	2.55	4	Fully attained	Not Applicable
b	2.55	4	Fully attained	Not Applicable
c	2.52	4	Fully attained	Not Applicable
d	2.43	4	Fully attained	Not Applicable
e	2.56	4	Fully attained	Not Applicable
f	2.80	4	Fully attained	Not Applicable
g	2.67	4	Fully attained	Not Applicable
h	2.33	4	Fully attained	Not Applicable
i	2.42	4	Fully attained	Not Applicable

14. Planned Actions for Course Attainment:

The courses having course level less than level-2 shall be addressed by designing the remedial measures like assignments, tutorials and remedial teaching.

15.Planned Actions for Program Outcome Attainment:

The POs having the level attained less than Level-4 shall be addressed by planning remedial measures for the corresponding courses w.r.t that PO.

ANNEXURE-B
COURSE OUTCOMES

WLM 111

Water and Land Resources Development and Utilization

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 regionalaization.
3. To analyse the diversion schemes and storage schemes,
4. To discover the biotic approach of environment management
5. To explain the Kautilyan management of water and land resource and thereby making the students capable of working in an agricultural sector.
6. To create awareness about the limited natural resources and make them able to manage judiciously

WLM-112

Survey, Leveling and Mapping

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.

WLM-113

Soil Science in Relation to water and Plant

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

WLM-115

Hydraulics

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 demonstrate the water measuring devices and experiment with the flow through v-notch, flumes and orifice.
4. To solve the problems related to water pressure and pressure head.
5. To measure the flow in open channel, close conduits
6. To design open channel flow using daray's equation, morning's equation and chezy's constant.

WLM 116 :

Computational Techniques

1. To apply/ implement computational techniques relevant to agricultural sciences
2. To explain the basic concepts related to conversion of units, basic mathematics, trigonometric functions,
3. To solve problems related to sampling techniques, classical optimization techniques, sensitivity analysis in the natural resources management

4. To apply these techniques in improving the efficiencies in various aspects of agricultural sector.
5. To prepare a unique solution of the problems arising in water and land management using the statistical tools.

(WLM-121)

Hydrology

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 analyze the variability of water resources of Maharashtra and India.
4. To estimate the static and flowing water availability in water body
5. To design and construct the water harvesting structures required in the state
6. To improve the hydrology of intercepted catchments and water availability indices

(WLM-122)

Advance Techniques in Water Application

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.

WLM 123

Agricultural Entrepreneurship

1. To undertake/design entrepreneurship and project management,.
2. To describe the role of entrepreneurs in realm of socio-economic development of the Nation.
3. To explain the functions and working of APMC and APEDA, MAIDC and MIDC.
4. To analyse the working of GATT and WTO with special reference to Indian agriculture and trade.
5. To apply the knowledge of the subject in constructing the new agricultural enterprises.

WLM 124

Legal aspects of water resource management

1. To develop technical insight within student about the legislative framework of water management.
2. It is designed to make the budding water managers sensitized to environment laws,
3. To compare traditional water laws with the provisions in constitution about water laws
4. To explain the structure, role and functioning of water user associations
5. To assist in formulating state and national water policies, inter-basin transfer of water
6. To describe water managers catering to the social demands along with the organizational priorities
7. To take part in environmental protection, to maintain and improve the soil health and re-use of water.

WLM-125

Research Methodology

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

WLM-126

Water Conveyance and Distribution System

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 prepare plan for municipal and industrial piped networks.
5. To solve the problem of land drainage.
6. To design irrigation and drainage management plan for getting maximum efficiencies.

WLM 127

Financial Management

1. To apply postulates, principles and techniques of accounting,
2. To describe agricultural finance, role of government in agricultural finance in the state and country

3. To assess the functioning of international financing agencies such as IMF, IBRD and UNESCO.
4. To evaluate modalities of financing at State, National and International level.
5. To compare the productivity of water and land under different pattern of use.
6. To apply the knowledge of finance and accounting for planning, decision making and control.

WLM-231

Integrated Watershed Management

1. To classify the natural resources available in a watershed
2. To outline the concept of watershed, watershed management, watershed planning
3. To develop the watershed budget of a watershed.
4. To categorize the land capability classes and their suitability for various uses.
5. To describe the importance of agroforestry, animal husbandary, dairy, poultry and other agro-based activities.
6. To solve the water scarcity problems in a watershed with people's participation and community infra structure.
7. To prepare a detail project proposal for implementation of watershed management programme.

(WLM-232)

Management of Irrigated Plants

1. To classify the crops and cropping pattern on various basis
2. To describe tillage operations and tillage implements for increasing soil tilth
3. To compare the indigenous methods of irrigation
4. To analyse the water management practices for irrigated plants.
5. To compare chemical farming with organic/sustainable agriculture.
6. To develop the nursery for raising seedlings.
7. To compare the performance of farm machineries used for agricultural operations.

(WLM-233)

Management Skills

1. To relate managerial functions with farm management
2. To apply leadership, group and team dynamics, conflict and negotiation skills
3. To apply management ethics in water and land management
4. To analyse generic skills (student's)
5. To develop abilities as a water manager for increasing the efficiency of water natural resources.

WLM-234

Research Methodology-II

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 find out the review of literature based on the research topic/ problem
5. To define the methodology for getting the objectives of the research study.
6. To obtain the observations on the regular basis.
7. To prepare the questionnaire for obtaining the primary data.

WLM-235 (Service Course)

INTEGRATED WATER RESOURCES MANAGEMENT

1. To explain the water wealth availability surface and ground water resources
2. To classify the branches of hydrology, types and forms of precipitation and runoff
3. To apply various methods for recharging the groundwater based on geological formations
4. To apply various methods for measurement of static and dynamic and water (formulae)
5. To compose the indigenous and modern methods of water application
6. To solve the water scarcity problem in rural area using the watershed management concept

7. To improve the water availability by applying various soil and water conservation techniques.

WLM- 236

SEMINAR

1. To describe the in-depth knowledge of a particular subject
2. To develop capable of evaluating their own opinions based on their perceptions.
3. To develop presentation and negotiation skills.
4. To create water managers capable of leading green movements
5. To improve the various aspects of students' personalities by giving presentations on the topic of their interest.
6. To evaluate the self-appraisal

(WLM-241)

Groundwater Management

1. To describe the water bearing formations present beneath the earth surface.
2. To analyse the groundwater exploration methods
3. To explain the regulated, optimum and judicious use of ground water resources.
4. To improve the ground water level in watershed by using groundwater planning, management and recharging.
5. To combine the judicious use of surface water and groundwater to augment the yield.
6. To make use of water bearing formations while drilling tubewells and recharging aquifers

WLM-242

Managerial Perspective

1. To relate students with organizational functioning
2. To classify organizations on the base of their functioning
3. To apply managerial decision making in farm management
4. To analyse modern management techniques in agriculture science

5. To create an awareness among farming community with legal aspects of marketing reforms.

WLM-243

Research Methodology-III

1. To apply the various research and scientific methods with reference to water and land management
2. To develop the technique involved in defining the problems.
3. To choose the appropriate method of analysis of data.
4. To apply the statistical tools for finding out the results of the research study
5. To compare the various methods used during the study period.
6. To test the hypothesis
7. To Compile the results and discussion and conclude the study.

WLM-244

DRINKING WATER MANAGEMENT

1. To make aware the students about the various purposes of water use.
2. To interpret the demand and supply of water and thereby the drinking water management.
3. To estimate the population of served area and select the proper method of population forecasting.
4. To visit the water purification plant and get acquainted with functioning of the various components of the plant.
5. To design and construct the roof top rainwater harvesting system for individual residences and public buildings.
6. To analyse the recycling and reuse of waste water.
7. To experiment with the various processes like sedimentation, coagulation, filtration and chlorination.

WLM-245

ENVIRONMENTAL ASPECTS OF WATER RESOURCES MANAGEMENT

1. To study the adverse effect of irrigated agriculture and industrial development related to water.
2. To sensitize the budding water managers about environment along with developing an understanding of inclusive and sustainable growth.
3. To assess the adverse environmental impacts such as water logging, salinity and alkalinity.
4. To develop technical insight in students about the legislative framework of environmental management.
5. To develop the mitigation measures such as drainage etc.

ANNEXURE-C
RESULTS OF CO-PO ATTAINMENT
WATER & LAND MANAGEMENT [30-40-50]

Course Title	a	b	c	d	e	f	g	h	i
Water and land Resources	3		3						
Practical	2		2						
Survey, leveling and mapping	2	2			2		2		
Practical	3	3			3		3		
Soil science in relation to water & plant	3		3			3			
Practical	3		3			3			
Computational techniques		3			3	3			
Practical		2			2	2			
Constitution of India				2				2	2
Hydrology	3		3						
Practical	2		2						
Advance techniques in water application	1		1	1	1				
Practical	3		3	3	3				

Agricultural entrepreneurship				1				1	1
Legal aspects of WRM				3				3	3
Research methodology				3	3	3	3	3	3
Financial management	1		1	1	1				
Integrated Water shade management		2	2	2	2				
Practical		3	3	3	3				
Management of irrigated plants	2		2	2	2				
Practical	2		2	2	2				
Management skills		2	2	2	2	2		2	2
Research Methodology				3	3	3	3	3	3
Seminar				3	3		3	3	
Optimization techniques	3	3	3	3	3	3	3		
Practical	3	3	3	3	3	3	3		
Service course				1			1	1	
Ground water management	3		3	3	3				
Practical	3		3	3	3				

Managerial perspective	3		3	3	3				
Dissertation				3	3	3	3	3	3
Drinking water management	3		3	3	3				
Practical	3		3	3	3				
	2.55	2.55	2.52	2.43	2.56	2.8	2.67	2.33	2.42

