GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma		Branch/Spec.	Agricultural Engineering	
Semester	III		Version	1.0.0.0	
Effective from Academic Year		2026-27	Effective for the Batch admitted in		July 2025
Course Code	1AE3102	Course Name	Groundwater and Drainage Engineering		

I. TEACHING, LEARNING AND ASSESSMENT SCHEME

Course Type	Course Code	Course Title	Total IKS Hrs for Sem	Learning Scheme					Credits	Examination Scheme										
				Actual Contact Hrs/week			SLH	NLH		TH				PR				SLA		Total
				CL	TL	LL				FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL				
												Max	Min			Max	Min	Max	Min	
DSC	1AE3102	Groundwater and Drainage Engineering	-	3	-	2	1	6	3	40	60	100	40	30	20	50	20	20	8	170

Abbreviations:	**CL**- Classroom Learning	**TL**- Tutorial Learning	**LL**- Laboratory Learning
	SLH- Self Learning Hour	**NLH**- National Learning Hour	**SLA**- Self Learning Assessment
	FA- Formative Assessment (Term work + Mid Exam + Attendance)		**SA**- Summative Assessment

II. PRE-REQUISITES

This course covers Applied Physics (water flow, pressure), Applied Maths (calculations, conversions), and Soil Science (texture, moisture). It also includes Environmental Studies (water resources, sustainability) and Irrigation Fundamentals (soil-water-plant relations). These basics help understand irrigation systems and water management.

III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES

Students can identify groundwater sources, classify aquifers, and assist in designing wells. They'll recognize problematic soils, plan drainage systems, and calculate requirements for reclamation. With these skills, they can work in irrigation, drainage, and soil reclamation projects, supporting land and water management.

IV. COURSE LEARNING OUTCOMES

CO-1. Understand the concepts of groundwater sources, aquifer types, and well hydraulics, including key terms such as drawdown, recharge, and aquifer characteristics.

CO-2. Analyze the types, construction, and functioning of open wells and tube wells, along with different methods of drilling, well development, and testing.

CO-3. Evaluate the impact of salt-affected soils (saline, alkaline, and acidic) and waterlogging on crop productivity, and assess suitable reclamation and management strategies.

CO-4. Apply drainage principles by selecting appropriate surface and subsurface drainage methods, considering soil properties, drainage coefficient, and design criteria.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Unit	Content	Hrs.
1	**Well hydraulics:** Groundwater sources, types of water bearing formation (confined and unconfined aquifer etc.) aquifer characteristics influencing yield of wells. Determination of aquifer constant, specific capacity of wells. Different terms related to well hydraulics such as water table isobaths, isobar lines, draw down recharge of ground water.	8
2	**Open wells and tube wells:** Types of wells, open wells their design parameters and construction of an open well, tube wells, methods of drilling tube wells-rotary drilling, core drilling and percussion drilling, well installation and well development objectives and methods. Testing of tube well.	7
3	**Salt affected soils and their reclamation:** Saline alkaline and acid soils, reasons and factors of their formation. Effect of salinity, alkalinity and acidity of plant growth. Reclamation of these soils and their management.	7
4	**Waterlogged soils and their drainage**: Waterlogging, causes of waterlogging and its effects. Drainage. Types of drainage systems *viz*., surface and subsurface drainage. Introduction to drainage investigation. Benefits of drainage. Drainage properties of soil. Drainage coefficient. Surface	8

	drainage-functional components, types (random drain, parallel field drain, parallel open ditch and bedding system used in flat areas and cross slope ditch system used in sloping areas). Introduction to design criteria and design parameters of open ditches. Benefits of subsurface drainage. Introduction to investigations for subsurface drainage, different methods of subsurface drainage *viz*., tile drains, mole drains, deep open drains and combination of tile and open drains.	

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL

1. To study the rainfall measurement system.
2. To study the types water bearing formations.
3. Study of different types of wells.
4. Different methods of groundwater investigations.
5. Study of different types of screen and strainers.
6. Determination of hydraulic conductivity under laboratory and field conditions.
7. Determination of drainable porosity.
8. Determination of drainage requirement.
9. To determine leaching requirement and gypsum requirement for reclamation of saline and sodic soils.
10. Study of different types of filters and strainers used in subsurface drainage systems.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

1. Groundwater Source Study by Survey nearby area to identify types of wells and aquifers
2. Salt-Affected Soil Reclamation Project by identifying saline/alkaline soil in nearby fields
3. Design a basic surface or subsurface drainage layout for a waterlogged field
4. Preparation of charts/models on: Aquifer types and Drainage systems
5. Case study on waterlogging problems in Gujarat
6. Video-based learning on tube well drilling and drainage systems
7. Visit to the tube well site/drainage project and submission of report

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD

1. Rain gauge (non-recording / recording type)
2. Permeameter (constant head & falling head)
3. Soil auger
4. Double ring infiltrometer
5. Hydraulic conductivity test setup
6. Drainable porosity apparatus
7. Groundwater level indicator
8. Soil EC meter and pH meter
9. Measuring cylinders and laboratory glassware
10. Gypsum requirement test kit
11. Aquifer and groundwater flow model
12. Open well and tube well models
13. Well screen and strainer samples
14. Surface and Subsurface drainage layout model
15. Salt-affected soil reclamation charts

IX. LIST OF REFERENCE BOOKS

1. Water well & pump engineering by A. M. Michael & S.D. Khepar; Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
2. Irrigation theory and practice by A.M. Michael; Vikas Publishing House, New Delhi.
3. Principles of agricultural engineering (Vol –II) by A.M. Michael & T.P. Ojha; Jain Brothers, New Delhi
4. Land and Water Management Engineering by V. V. N. Murthy

X.LINK OF LEARNING WEB RESOURCE

1. https://www.youtube.com/@icarindia
2. https://www.youtube.com/@nptelhrd
3. https://nptel.ac.in/
4. https://jalshakti-dowr.gov.in/
5. https://agricoop.nic.in

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	U-Level	R-Level	A-Level	Total Marks
1.	Well Hydraulics	CO1	8	10	12	8	30
2.	Open Wells and Tube Wells	CO2	7	8	10	6	24
3.	Salt Affected Soils and Reclamation	CO3	7	8	8	6	22
4.	Waterlogged Soils and Drainage	CO4	8	10	10	8	28
		Grand total	30	36	40	28	104

XII. COs AND POs AND PSOs MAPPING

Course Outcome (Cos)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	1	2	2	1	-
CO2	3	3	2	2	1	-	1	3	2	-
CO3	2	3	2	-	-	2	3	3	2	1
CO4	2	3	3	2	-	-	3	3	3	2

Legends: - 3- High 2-Moderate/Medium 1-Slight/Low 0-None