FIRST YEAR COURSE STRUCTURE FOR M. TECH. IN WATER RESOURCES DEVELOPMENT AND MANAGEMENT

FIRST SEMESTER

A. Theory							
Sl. No	**Paper Code**	**Name of Paper**	**Contact Periods/Week**				**Credits**
			L	T	P	Total	
1	WRM101	Hydrology & Water Resources Engineering	4	2	-	6	6
2	WRM102	Remote Sensing for Land and Water Resources	3	2	-	5	5
3	WRM103	On-Farm Irrigation and Drainage Engineering	3	2	-	5	5
4	MAE104	Elective-I	3	2	-	5	5
Total Theory						**21**	**21**
B. Practical							
5	WRM105	Hydrology and Water Resources Engineering Lab	-	-	3	3	2
6	WRM106	On-Farm Irrigation and Drainage Engineering Lab	-	-	3	3	2
Total Practical						**6**	**4**
Total of Semester:						**27**	**25**

SECOND SEMESTER

A. Theory							
Sl. No	**Paper Code**	**Name of Paper**	**Contact Periods/Week**				**Credits**
			L	T	P	Total	
1	WRM201	Water Well and Pump Engineering	3	1	-	4	4
2	WRM202	Land Husbandry and Watershed Management	3	2	-	5	5
3	MAE203	Elective-II	3	2	-	5	5
4	MAE204	Elective-III	3	2	-	5	5
Total Theory						**19**	**19**
B. Practical							
5	WRM205	Water Well and Pump Engineering Lab	-	-	3	3	2
6	WRM 206	Seminar	-	-	6	6	4
Total Practical						**9**	**6**
Total of Semester:						**28**	**25**

SECOND YEAR COURSE STRUCTURE FOR M. TECH. IN WATER RESOURCES DEVELOPMENT AND MANAGEMENT

THIRD SEMESTER

A. Theory							
Sl. No	**Paper Code**	**Name of Paper**	**Contact Periods/Week**				**Credits**
			L	T	P	Total	
B. Practical							
1	WRM 301	Thesis Part-I	-	-	-	-	15
2	WRM 302	Comprehensive Viva Voce	-	-	-	-	10
Total Practical						**-**	**25**
Total of Semester:						**-**	**25**

FOURTH SEMESTER

A. Theory							
Sl. No	**Paper Code**	**Name of Paper**	**Contact Periods/Week**				**Credits**
			L	T	P	Total	
B. Practical							
1	WRM 401	Thesis Part-II	-	-	-	-	25
Total Practical						**-**	**25**
Total of Semester:						**-**	**25**

Elective Subjects (Elective I/II/III): M.Tech. - Water Resources Management

1. GIS and GPS–principles and application in Agriculture
2. Modelling and Simulation for Agricultural Water Management
3. Mathematical Models in Hydrology
4. Advanced Groundwater Hydrology
5. Water Resources System Analysis
6. Soil Conservation Structure Design
7. Water Resources Planning, Economics & Management
8. Advanced Techniques for Ground Water Exploration and Development
9. On-Farm Water Management
10. Minor Irrigation and Command Area Development
11. Aqua cultural Engineering
12. Programming and Data Structure

DETAIL SYLLABUS FOR THE M. TECH. COURSE IN WATER RESOURCES DEVELOPMENT AND MANAGEMENT

WRM 101 (4-2-0): Hydrology and Water Resources Engineering

Unit-I

Need for sustainable water management, hydrologic processes, global water scenario, water budget in India, irrigation development, major issues in land and water resources management

Unit-II

Frequency analysis of hydrologic events, frequency distribution models, rainfall intensity-duration and frequency relationships,

Unit-III

Model structure for time series, structural analysis, stationary series, non-stationary series analysis,

Unit-IV

Hydrographs, flood routing, system models, conceptual and dynamic models of runoff hydrograph.

Unit-V

Types of storage structures, water yield from catchments, runoff diversion, ponds and reservoirs, reservoirs and planning for dam reservoirs, earthen embankments and dams.

Suggested readings:

1. Subramanyam, K.. Engineering Hydrology, Tata McGraw Hill Publication Co., New Delhi
2. Sharma, R. K. Hydrology and Water Resources Engineering, Dhanpat Rai and Sons,
3. Chow, V. T. Handbook of Applied Hydrology. McGraw Hill Book Co., USA
4. Garg, S.K. Hydrology and Water Resources Engineering, Khanna Publishers, ND.
5. Das, Ghanashyam. Hydrology and Soil Conservation Engineering, Prentice Hall of India, Pvt. Ltd, New Delhi

WRM 102 (3-2-0): Remote Sensing for Land and Water Resources

Unit-I

Basic principle of remote sensing, sensor, platforms, data analysis

Unit-II

Principal remote sensing approach for quantitative estimates of precipitation, visible and infrared techniques, space borne radar, ground based radar, cloud indexing methods, thresh holding methods, life history methods microwave radiometry

Unit-III

Principal remote sensing approach and current applications for estimates of runoff, evapotranspiration.

Unit-IV

General approach for measuring soil moisture, Gamma radiation techniques, visible/near-infrared techniques, thermal, microwave techniques. exploration of groundwater with satellite imagery, principles of image analysis, imagery selection, water quality.

Unit-V

General approach for water resources management and monitoring using remote sensing, flood monitoring, measuring flooded areas, flood plain mapping.

Suggested readings:

1. Sabins, J.R. Remote Sensing Principles and Interpretations. W. H. Freeman & Co.
2. Burrough, P. A. Principles of GIS for Land Resources Assessment
3. Shultz, G. A. and Engman, E. T. Remote Sensing in Hydrology and Water Management, Springer, New York.
4. Crisman Nicholas. Exploring GIS. John Wiley and Sons.
5. Heywood, Ian., Cornelius Sarah and Carver Steve. An Introduction to GIS, Addission-Wesley-Longman.

WRM 103(3-2-0): On-Farm Irrigation and Drainage Engineering

Unit-I

Sources of irrigation distribution system, Irrigation water measurement, Plant-soil-water interaction: Scheduling of irrigation.

Unit-II

Design and evaluation of surface and sub-surface systems-sprinkler and drip systems, Role of plastics in irrigation water management.

Unit-III

Irrigation pumps, automation in irrigation, planning and economics of integrated irrigation system-case studies.

Unit-IV

Drainage problems of various agro-climatic regions, determination of saturated hydraulic conductivity, steady and un-steady flow equations in sub-surface drainage system, sub-surface drainage systems design.

Unit-V

Surface drainage systems design, drainage of rice fields, influence of irrigation on drainage, analysis of water balance, salinity control, agricultural drainage criteria, standard mathematical models used in agricultural drainage design.

Suggested readings:

1. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
2. James, L. G. Principles of Farm Irrigation System Design, John Wiley and Sons, USA
3. Walker, W.R. and Skogerboe, Q. V. Surface Irrigation: Theory and Practice, Prentice Hall Inc. New Jersey, USA
4. FAO. Drainage Machinery. Irrigation and Drainage Paper No. 15. Food and Agricultural Organisation, Rome.

5. ISO. UPVC Pipes and fittings for use in subsoil drainage Specifications. Publication No. ISO/TC 138 WGIN431. ISO Din Deutsches Institut fur Normurig C.V. Ber-Jin 30.
6. Garg, S. K. Irrigation and Hydraulic Structures. Khana Publishers, New Delhi
7. Garg, S. K. Hydrology and Water Resources Engineering. Khana Publishers, New Delhi

WRM 105 (0-0-3): Hydrology and Water Resources Engineering Lab

1. Rainfall and runoff analysis,
2. Design of rainfall and stream gauging networks,
3. Planning of meteorological observatories,
4. Measurement and computation of stream flow and sediment transport,
5. Measurement and analysis of hydrologic data (Precipitation, stream flow, evaporation and transpiration),
6. Design of Rain gauge network,
7. Measurement of flow in pressure conduits,
8. Water characteristics and quality determination.

WRM 106 (0-0-3): On-Farm Irrigation and Drainage Engineering Lab

1. Design of irrigation tanks and wells.
2. Determination of well capacity by pumping test.
3. Measurement of irrigation water.
4. Determination of infiltration characteristics of soil.
5. Advance and recession flow in border and check basin and furrow methods.
6. Design and evaluation of sprinkler and drip methods of irrigation.
7. Land grading and land levelling
8. Design of surface and sub-surface drainage system

WRM 201 (3-1-0): Water Well and Pump Engineering

Unit-I
Aquifers - hydraulic characteristics of aquifers. Basic principles of ground water flow, ground water investigation.

Unit-II
Well hydraulics. Steady and unsteady flow through fully penetrating and partially penetrating wells in confined, semi-confined and unconfined aquifers. Flow through non-penetrating wells, determination of aquifer parameters by pumping test data analysis.

Unit-III
Well design, groundwater recharge basins and injection wells, multiple well and interference between wells, flow into aquifer with different boundaries, groundwater quality management.

Unit-IV
Study of indigenous water lifts. Operating principles of hydraulic ram. Principles of positive displacement, jet and air-lift pumps. Design of reciprocating pump. Design of centrifugal pump-impeller and casing.

Unit-V
Pump characteristics, selection of size and type of pump, optimization of pump efficiencies, pump testing and modification, pump installation, operation and maintenance, pump troubles and remedies. Pumps in series and parallel. Special operating conditions. Design of farm irrigation system network, installation and its optimization. Economics of alternative pumping plant design.

Suggested readings:

1. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
2. Michael, A. M. and Khepar S.D. Water Well and Pump Engineering, Tata McGraw Hill Publication Co., New Delhi
3. Church, A. H. and Jagdish Lal. Centrifugal Pumps and Blowers. Metropolitan Book Co. Pvt. Ltd. New Delhi
4. Bansal, R. K. A text book of Fluid Mechanics and Hydraulic Machine. Laxmi Publications, New Delhi.

WRM 202 (3-2-0): Land Husbandry and Watershed Management

Unit-I
The concept of watershed, objectives, characteristics, delineation and coding of watershed, importance of land husbandry in watershed management.

Unit-II
Watershed development plan, programmes in retrospect, NWDPRA, the hariayali progrrame, common guide lines.

Unit-III
The problem of soil erosion and conservation, agronomic measures in watershed management, Land preparation and planting methods for conservation

Unit-IV
Land capability classification and land use in the humid tropics, more crops per drop: importance of water management

Unit-V
Maintenance of soil fertility, Organic Recycling: Role of manures, composts and bio fertilizers, fertilizers and their management, diversity farming system for sustainability

Suggested readings:

1. Suresh, R. Soil and Water Conservation Engineering. Standard Publishers, and Distributors, New Delhi
2. Suresh, R. Watershed Hydrology. Standard Publishers, and Distributors, New Delhi
3. Schwab, G. O., Fangeir, D. D., Edminister, W. T., and Frevert, R.K. Soil and Water Conservation Engineering, John Wiley and Sons.

4. Murty, V.V.N. and Jha, M. K. Land and Water Management Engineering. Kalyani Publisher, Ludhiana, India
5. Murty, V.V.N. and Takeuchi, D. K. Land and Water Development for Agriculture in Assia-Pacific Region. Oxford and IBH Publishing Co. New Delhi.
6. Tideman, E.M. Watershed Management (Guidelines for Indian Conditions) Omega Scientific Publishers, New Delhi.
7. Sing, Rajvir. Watershed Planning and Management. Yash Publishing House, Bikaner.
8. Dhruvanarayan, V.V. Sastry, G., Patnaik, V. S. Watershed Management. Publ. And Inf. Div. ICAR, New Delhi.

WRM 205(2-0-3): Water Well and Pump Engineering Lab

1. Design of different wells.
2. Determination of well capacity by pumping test.
3. Study of different types of water lifts and pumps-calibration.
4. Dissembling and assembling water lifts.
5. Development of performance characteristic curves of a pump using a test rig.
6. Design of centrifugal pump-impeller and casing.
7. Pumping test in an aquifer.

AE-301: Thesis Part-I: Formulation and Planning of the project

AE-401: Thesis Part-II: Work Execution and Thesis Compilation