

S.S.JAIN SUBODH P.G. (AUTONOMOUS) COLLEGE
(Affiliated to University of Rajasthan)



Syllabus

Department of Environmental Science
P.G. DIPLOMA

IN

Water Harvesting and Management System
(PGD-WHMS)

Preamble:

Industrialization is basically considered for the comfortable living of human beings. We are getting different types of goods and luxuries due to industrial products though, these are positive aspects of industrialization, along with the development in science and technology the calamities related to industries and environmental pollution problems are increasing day by day. Bhopal Gas Tragedy, Chernobyl Accident, Three Mile Island Nuclear Accident, etc. are some of the examples of safety violation. The above mentioned incidences are to enough to understand the severity of Industrial calamities. To avoid such circumstances various laws and orders implementation is necessary but not the fact is that not only laws but proper training and education about safety rules and their implementation are prior requirements for any industry. In this ever increasing era of industrialization, accidents are becoming a part of process and therefore, there is need of qualified and experienced manpower that can handle the complex industrial situations and avoid the calamities. Nowadays, there is high demand for such safety professionals from different industries. In many nations, it has been made mandatory to appoint well trained and qualified professional for the Industry. Every year around 20 students from our college and 100s of students from other Department of Environmental Science complete M. Sc. degree and join Environmental Consultancy or Industry as an Environmental Professional. With their M. Sc. Environmental Science, if they get add-on course as a P.G.Diploma in **Industrial Safety Health and Environment which is compulsory under *Factories Act, 1948*** for a person joining industry as Environment and Safety Officer, these students will get immediate entry in the industry and good salary package after completion of their P.G. Considering the present scenario in mind, Department of Environmental Science, propose to start P.G. Diploma in Water Harvesting and Management System (PGD-WHMS). The course is designed for the students and employees from industries who will be exposed to comprehensive and rigorous training covering all areas of Safety, Health and Environmental management.

Objectives :

To develop highly qualified professional manpower the basic requirement lies on systematic quality based coaching and training in Advanced Science and Technologies. Therefore, the course is designed to train and provide expert human resource to safety management and expected to bring direct benefits to industry and society. The course is based on following objectives:

- ✓ To develop an expert manpower to handle the complex industrial environment.
- ✓ To give knowledge about occupational health, industrial hygiene, accidental prevention techniques to the students.
- ✓ To make the student aware about safety auditing and management systems, pollution prevention techniques etc.
- ✓ To train the students about risk assessment and management.
- ✓ M. Sc. Environmental Science students will get an add on diploma.
- ✓ It will produce well trained, qualified and expert manpower for the Industrial sector.
- ✓ Better placement opportunity for M. Sc. Environmental Science students.
- ✓ Course will be useful for in-service people from the industry.
- ✓ More interaction between Institution and Industry

Eligibility for Admission:

A candidate who has secured more than 55% or CGPA of 3.5 in the UGC Seven Point scale [36% or Pass marks for SC/ST/Non-creamy layer OBC/SBC] or equivalent in the Bachelor degree in Science or Engineering or Technology or Medicine or Pharmaceutical Science shall be eligible for admission to First Semester of P.G. diploma in Industrial Safety Health and Environmental Management course. For candidates from outside state of Rajasthan 60% or CGPA of 4.0 in the UGC Seven Point Scale will be applicable irrespective of the category

Academic Duration of Course and Examination:

The course will complete in one year duration. course includes two times internal assessment/Assignments also includes lab work and Industrial training/ relevant institutional training/Consultancy training in authorized consultancies etc.

Proposed course for P.G.D. in *Water Harvesting and Management System(PGD-WHMS)**

Course structure and Scheme of Examination:

1. Each theory paper carries 100 marks. The internal assessment will be 30 marks and EoSE shall carry 70 marks. The EoSE will be of 3 hours duration. There will be a practical examination of 100 marks in all Semester based on the theory paper/industrial Training.
2. There will be two parts in EoSE theory paper. Part „A“ of theory paper shall contain 10 Short Answer Questions of 14 marks, based on knowledge, understanding and applications of the

topics/texts covered in the syllabus. Candidate has to attempt seven questions out of 10 and each question will carry two marks for correct answer.

3. Parts “B” of EoSE theory paper will consist of four questions from each unit with internal choice of 14 marks each. The limit of answer will be five pages.

4. Each Laboratory EoSE will be of four hour durations and involve laboratory experiments/exercises/ Seminar presentation Project work or field study / Industrial Training/ consultancy training and viva-voce examination consisting of 100 Marks.

5. The aim of Project work or field study / Industrial Training/ consultancy training is to introduce students to research methodology in the subject and prepare them for pursuing research in theoretical or experimental or computational areas of the subject. The project work or Field Study is to be undertaken under guidance jointly by Head of the Department and a senior faculty or a Scientist or any other suitable person with proven research excellence in the concerned field of study. Project work or field study / Industrial Training/ consultancy training can also be taken up in an outside institution of repute Department. The guide will make continuous internal assessment of the Project work or field study / Industrial Training/ Consultancy training. EoSE for Project work or field study / Industrial Training/ consultancy training and seminar will be held at department of the college by a board of three examiners consisting of HoD, two senior faculty of the department or expert from interdisciplinary department of the institution.

6. Supplementary/ due paper/ special examinations will be resolute as per the institutions autonomous rules

7. Grade/CGPA/percentage/division will be decided as per the autonomous guidelines of the institution.

Proposed course for P.G.D. in WHMS*

S.No.	Code	Paper Title	Theory Hours	Practical Hours	Marks		Total
					External	Internal	
1.	WHMS 1	Fundamentals of Water Hydrology			70	30	100
2.	WHMS 2	Legal Framework of Water Resources and Auditing			70	30	100
3.	WHMS 3	Hydro Chemistry And Tools Techniques			70	30	100
4.	WHMS 4	Watershed conservation and Harvesting Techniques			70	30	100
5.	WHMS 5	Environmental Impact Assessment of Water Resources			70	30	100
6.	WHMS PBT6	Practical Based on Theory Paper /In-plant Training and Visits Project			60	40	100

PAPER -I FUNDAMENTALS OF WATER HYDROLOGY:

Duration: 3 hrs.

Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain seven short answer questions of 14 marks. Each question will carry two marks for correct answer.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

UNIT- I

Origin of groundwater, Rock properties affecting groundwater, Types of aquifer, Darcy's law, coefficient of permeability, groundwater flow rates, permeability formulae, laboratory and field measurement of permeability, Groundwater movement, Surface water hydrology – rainfall and surface runoff relationship, runoff characteristics, open channel flow, Water balance.

UNIT-II

Water quantity/quality assessment and management, Water conservation measures, Water-harvesting structures, Reduction of water losses, Introduction and basic concepts: Concept of watershed, Introduction to watershed management, different stakeholders and their relative importance, Rainfall pits and rain water harvesting, Contour bunding, Watershed management policies and decision making.

UNIT-III

Soil-Conservation Strategies: soil moisture (soil moisture meter, gravimetric method, capacitance probe, Time domain reflectometer, Tensiometer). Concept of land husbandry, Field-level and watershed-level strategies. Indigenous technologies, Soil Erosion Modeling and Soil-Conservation Research.

Books:

Paper II: Legal Framework of Water Resources and Auditing

Duration: 3 hrs.

Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain seven short answer questions of 14 marks. Each question will carry two marks for correct answer.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

UNIT- I: Historical Background And Current Status: Water Policy, Bill, Act, Rules, Notifications in India; An overview, evolution of water law, key features of water law, evolving water law and policy, water sector reforms, water law reforms, Role of Law in Water Management – Conceptions of Water: Commodity, Service, Human Right

UNIT- II: Water Legislation In India And Framework: Pre-Constitutional Water Laws – Constitutional Provisions: Article 14, Article 21, Directive Principles of State Policy, Fundamental Duties, National and International Framework for Water Law; human fundamental right to water and the basic constitutional scheme for determining the jurisdiction over water, from the local to the national level, Government policies for drinking water.

UNIT-III: Transboundary Water Legislation: International Water Law – Emerging Principles - International Law Commission – International Treaties and Protocols – Transboundary Water Issues in India and Indus Waters Treaty – India-Nepal Treaty – Indo-Bangladesh Cooperation – Sharing of Nile and Mekong River Basins

Books:

1. Water Law in India- An Introduction to Legal Instruments. 2011. Philippe Cullet and Sujith Koonan Print ISBN-13: 9780198070818, Published to Oxford Scholarship Online: September 2012
2. “Law for Water Management – A Guide to Concepts and Effective Approaches”, Ed: Jessica Vapnek, Brace Aylward, Christie Popp and Jamie Bartram, FAO, Rawat Publications, New Delhi, 2011.
3. Handbook of Environmental Laws, Acts, Rules, Guidelines, Compliances and Standards, Vol. I and II, BS Publications, Hyderabad.
4. B.L.Chavan, A.R.Shahane and C.S. Rawandale, Introduction to Environmental Legislation, Asian Inst. Env. Law., Karmala.

PAPER III- HYDRO CHEMISTRY AND TOOLS TECHNIQUES

Duration: 3 hrs.

Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain seven short answer questions of 14 marks. Each question will carry two marks for correct answer.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit-I: Introduction to hydro chemistry of water, chemical composition of water samples, structure and bonding of water, Formation of hydrogen bonding, Structure of ice, Auto ionization, amphoteric nature, electrolysis of water.

Unit-II: Interpretation of chemical Data- Ionic formula, Ionic ratios, Chemical processes occurring in groundwater-Dissolution and precipitation, Adsorption and Ion Exchange, Mixing, Oxidation, Reduction, membrane effects, water quality monitoring and preventive measures, Trilinear Plots, Piper, Logrithmic diagram-Schoeller, Mixing diagrams.

Unit-III: Principles of Analytical methods, Spectroscopy, photometry, chromatography, Atomic absorption spectroscopy, Chromatography, TLC – paper and ionexchange, Electrophoresis, X-ray fluorescence, Flame photometry; Complexometric titrations, Principles of Photochemistry.

Books:

1. Lillesand, T.M. and Kiefer, R.W., Remote Sensing and Image Interpretation III Edition. John Wiley and Sons, New York. 1993. 2. Burrough P.A. and McDonnell R.A., Principles of Geographical Information Systems,.Oxford University Press. New York. 1998.
2. Comprehensive Environmental Impact Assessment of Water Resources Projects : With Special Reference to Sathanur Reservoir Project (Tamil Nadu)/K. Discovery Pub., Chari. B., Richa Sharma and S.A. Abbasi, New Delhi, 2005.
3. The Politics of Water – A Survey”, Ed: Kai Wegerich and Jeroen Warner, Taylor and Francis Group, London, 2010.
4. Transboundary Freshwater Dispute Resolution – Theory, Practice and Annotated References, Heather L. Beach et. al., (2000), UN University Press

PAPER IV INTEGRATED WATERSHED CONSERVATION AND HARVESTING TECHNIQUES

Duration: 3 hrs.

Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain seven short answer questions of 14 marks. Each question will carry two marks for correct answer.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit-I: Watershed delineation, Objectives of planning watershed projects, guidelines for project preparation. Soil and water conservation practices, Water Conservation measures, gully control, terracing, building check dams, reclamation of soils, Water harvesting- rainwater harvesting and roof water harvesting.

Unit-II: Water Harvesting and Conservation: Water Harvesting Techniques – Micro-Catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment

Unit-III : Watershed Management: Project Proposal Formulation - Watershed Development Plan – Entry Point Activities – Estimation – Watershed Economics - Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes – Developing Collaborative know how – People’s Participation – Evaluation of Watershed Management. Watershed Standard Modeling

Books:

1. Jayaram Reddy, A Text Book of hydrology, Lakshmi publishers, New Delhi.
2. Subramanya.K, Hydrology for Engineers, Tata Mc Grace Hills Publications, New Delhi, 1984.
3. Todd.D.K. Ground water hydrology; John Wileys & Sons Publications, New York.
4. Ragnunath, H.M, Hydrology, Villey tastem publication, New Delhi, 1985.

Paper-V Environmental Impact Assessment of Water Resources Development

Duration: 3 hrs.

Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain seven short answer questions of 14 marks. Each question will carry two marks for correct answer.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

UNIT-I: Environmental Issues: Water resources development and environmental issues, Environment in water resources project planning, Environmental Impacts: Hydrological and water quality impacts, Environmental regulations and EIA notification.

UNIT II : EIA Fundamentals: Environmental Impact Assessment (EIA), EIA in Project Cycle – Legal and Regulatory aspects in India according to Ministry of Environment and Forests – Types and limitations of EIA, Participation of Public and Non-Governmental Organizations in environmental decision making.

UNIT III: Methods of EIA: EIA team formation, Development of scope, mandate and study design, Base line survey, Check lists – Ad hoc procedures, Network and matrix methods, Semi-quantitative methods, Economic approaches. Environmental Impact Statement (EIS), Ecosystem services – Environmental monitoring programs.

Books:

1. Environmental Impact Assessment. Canter, L.W, McGraw Hill International Edition, New York. 1995.
2. Environmental Impact Assessment. Barathwal, R.R., New Age International Publishers, New Delhi. 2002.
3. Handbook of Environmental Impact Assessment, Petts, J., Vol., I and II, Blackwell Science London. 1999.
4. Hydrology and global environmental change. Arnel, N., Prentice Hall, Harlow. 2002.