

PROSPECTUS

M.Tech. Programme
in
Conservation of Rivers and Lakes

Academic Session 2010-2011



ALTERNATE HYDRO ENERGY CENTRE
INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

For Sponsored Candidates

PROSPECTUS

for

**Master of Technology (M. Tech.) Programme in
“Conservation of Rivers & Lakes” (CRL)**

**Academic Session
2010-2011**

Sponsored by

Ministry of Environment & Forests
National River Conservation Directorate
Government of India



**INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE
(UTTARAKHAND), INDIA**

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1.0 INTRODUCTION

1.1 NEED FOR THE PROGRAMME

The programme of pollution abatement of rivers was started by the Ministry of Environment & Forests (MoEF), Government of India with the launching of the Ganga Action Plan (GAP) Phase I in June 1985. A Central Ganga Authority under the Chairmanship of Prime Minister was constituted to finalize the policy framework and to oversee the implementation of the Action Plan. Chief Ministers of concerned States, Union Ministers and Secretaries of the concerned Central Ministries and experts were its members. This plan was a 100% Centrally Sponsored Scheme. Later in April 1993, Yamuna and Gomti Action Plans were approved under a new scheme of GAP Phase II. This was followed by approval of pollution abatement programmes of other polluted rivers of the country in July 1995 under the National River Conservation Plan. The Central Ganga Authority was reconstituted and re-named as the National River Conservation Authority under the Chairmanship of the Prime Minister. Both GAP Phase II and NRCP were approved as Centrally Sponsored Schemes with 50:50 cost sharing basis between the Central and the concerned State Governments. Ganga Action Plan Phase-II was later merged with NRCP in December 1996.

National River Conservation Plan (NRCP) at present, extends to towns along polluted stretches of major rivers in States. The various components included under the scheme are laying of sewers, construction of sewage treatment plants, pumping stations, management of solid waste, provision of low cost toilets and crematoria, shifting of dhobi ghats, improvement of bathing ghats, afforestation along rivers, public participation facilitate in improving the environment within the town. The share of the Central Government in the programme is now limited to 70% of the total cost of the new scheme with the remaining 30% cost coming from State Government/local bodies. The Operation & Maintenance of all assets is the responsibility of the State Government/local bodies.

Apart from this, the MoEF is also implementing the National Lake Conservation Plan (NLCP) with a funding pattern of 70:30 between the Central & State Governments. The objective of the scheme is to take up conservation of urban lakes as they are seriously

threatened with environmental degradation. The thrust under the plan is to undertake *in situ* remedial measures for the lakes such as interception, diversion and treatment of sewage discharged into the lakes, solid waste management, catchment area treatment and lake front development (beautification). So far 42 lakes have been taken up for conservation and improvement under NLCP.

Recently under Jawaharlal Nehru National Urban Renewal Mission (JNNURM) launched by Ministry of Urban Development, Government of India, focussed financial support is being provided to State Government and their urban local bodies for efficient urban infrastructure projects related to water supply, sanitation, sewerage, solid waste management, road network, urban transport and service delivery mechanism covering community participation and accountability towards citizens.

The need to create adequate and properly trained manpower in the various scientific & technical, social, economic, administrative aspects of conservation of rivers and lakes has long been felt. MoEF have the responsibility of the National River/Lake Conservation programmes. Trained manpower is needed, among other items, to:

- Prepare and implement programme/projects / schemes of environmental conservation
- Operate and maintain the assets created under conservation of water bodies
- Monitor the environmental status of rivers and lakes

To create trained manpower in the country, the MoEF has sanctioned the funding of an interdisciplinary Master of Technology (M. Tech.) programme in “*Conservation of Rivers and Lakes*” at Indian Institute of Technology, Roorkee (IITR) for the officers from Central, State and local governments and their organisations involved in river and lakes conservation programme.

Departments including Alternate Hydro Energy Center (AHEC), Biotechnology, Chemical Engineering, Civil Engineering, Hydrology and Management Studies at IITR are offering this programme with the AHEC as the Coordinating Department.

1.2 ABOUT INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE (IITR)

Roorkee is the oldest seat of technical education in the East. The erstwhile Thomason College of Engineering was founded in 1847 and was raised to the status of the University in 1949 having the distinction of becoming the first technical University in India. University of Roorkee has been converted to IITR on September 21, 2001. During the past 163 years, the Institute has played a leading role in development of the country through technical education, research and extension services. The faculty and alumni of the Institute have distinguished themselves in India and abroad through their contributions & achievements. Delivering the centennial address, Pandit Gobind Ballabh Pant, the first Chief Minister of Uttar Pradesh, described the then University of Roorkee (Now Indian Institute of Technology, Roorkee) as “ the jewel in the Crown of Uttar Pradesh

The Institute has departments of Engineering, Science, Management & Humanities besides a number of centres of higher education and research. Roorkee has the added advantage of interaction with and cooperation of academic institutions such as the State Irrigation Research Institute, the National Institute of Hydrology and the Central Building Research Institute.

IITR is a fully residential Institute. The programme participants are provided accommodation in the bachelor hostels (called Bhawans) of the Institute. However, limited family accommodation, as and when available, may also be provided.

1.3 ABOUT ROORKEE

Roorkee (Latitude 29° 52'00" N and Longitude 77° 53' 52") is a small town in Haridwar district of newly created Uttaranchal State. Its elevation is 261m above mean sea level. On a clear day, it presents a fine view of snow clad Himalayan peaks. The place is within easy reach from New Delhi, the capital of India, the distance being about 180 km by road. It is also connected by Rail.

The temperature ranges from 5°C to 20°C in winter (October to March) and from 25° to 40°C in Summer (April to September). The average annual rainfall is 1100 mm & bulk of it occurs from middle of June to middle of September.

Roorkee also hosts the Bengal Engineering Group and the Centre of Army Corps of Engineers.

1.4 ABOUT PARTICIPATING DEPARTMENTS

1.4.1 Alternate Hydro Energy Centre

AHEC has been engaged in human resource development in the field of Renewable Energy in general and Small Hydro Energy in particular since its inception in the year 1982. It offers a four semester Master of Technology (M.Tech.) course in ‘Alternate Hydro Energy Systems’ open to fresh engineering graduates as well as to the practicing engineers, technologists, officers and scientists drawn from India and other developing nations. AHEC also offers two elective subjects on Renewable Energy and Small Hydropower development to engineering bachelor students of the Institute. It has been organising national and international short term training programmes for field engineers and technologists in the field of small hydropower and energy regulation etc. In addition facilities for research and development leading to Ph.D. are available. The centre with its vast experience of working on various aspects of Small Hydro Power (SHP) offers consultancy in and outside the country.

Since its inception, the AHEC is also working in the area of environment & has handled a number of prestigious projects. These assignments include environment impact assessment of development projects and eco-restoration of water bodies like preparation of detailed project reports for the conservation and management of Dal & Nagin lake in Srinagar (J&K), 5 lakes in Nainital in Uttaranchal, pollution abatement of rivers at Bhubaneswar, review of proposals of conservation of Husain Sagar (Hyderabad), Lake in Kodaikanal etc. Report of the Working Group set up for 11h plan for the programme of Conservation of Rivers and Lakes of the MoEF has been prepared. AHEC has also carried out the evaluation of the Yamuna Action Plan, a plan executed for the improvement of the water quality of river Yamuna.

Faculty members of AHEC drawn from multi disciplinary fields of Civil, Mechanical, Electrical, Chemical, Electronics and Computer Engineering and Chemistry have gained excellent expertise in the entire gamut of activities related to renewable energy and Eco-restoration. AHEC has received recognition from IREDA, SESI and others.

AHEC has signed Memorandum of Understanding (MoU) to work as an expert organisation for SHP development with Uttaranchal State Government, Bihar State Hydroelectric Power Corporation Himurja (Govt of Himachal Pradesh) and J & K State Power Development Corporation. It has set up instrumentation laboratory to provide independent performance testing of small hydropower plants as the sole certifying testing organisation for MNRE.

A real time digital simulator for Small Hydropower plants has been established at AHEC to design, simulate and impart training for small hydropower plant personnel. Standards for Small Hydropower plants are being developed.

1.4.2 Department of Biotechnology

A center of Bio-sciences was started in 1980 and was upgraded to a full-fledged academic Department of Bio-sciences and Biotechnology in 1986. It has been renamed as Department of Biotechnology in the year 2002. It has teaching and research programmes, which draw heavily on the basic knowledge of modern biology, biochemistry, biophysics and chemical engineering, particularly at cellular and molecular levels. The Ministry of Human Resource Development (MHRD) has created a strong infrastructure base for advanced research in “Bio-conversions” in the Department.

The Govt. of India has recognized the Department by sponsoring the M. Sc. (Biotechnology) programme. At present, the research focus is on microbial biotechnology, DNA-drug interactions, reproductive endocrinology, genetic engineering of nitrogen fixation and molecular biology.

1.4.3 Department of Chemical Engineering

The Department of Chemical Engineering was established in 1963 with the Undergraduate programme in Chemical Engineering. Currently the Department is running a B. Tech. (Chemical Engg.) programme and Integrated Dual Degree (IDD) programme in B.Tech. (Chemical/M.Tech. Hydrocarbon) alongwith three M. Tech. (Chem. Engg.) programmes, namely Computer Aided Process Plant Design Industrial Pollution abatement and Industrial safety and Hazard Management. The department has well qualified faculty to undertake research activities in the traditional and emerging areas of Chemical

Engineering-process integration, process intensification, clean technology, modeling and simulation, control, biochemical engineering, hydrocarbon engineering and environmental engineering. Five centers of advanced research in various areas have been established in the department. The Department is actively engaged in providing consultancy to chemical and allied industries.

1.4.4 Department of Civil Engineering

The Department of Civil Engineering, the oldest in the country and perhaps in Asia is a worthy successor of the Thomason College of Civil Engineering of 1847 vintage. Apart from the Bachelor’s degree programme, the Department offers Master’s degree programme in eight different specializations with a possibility of diversification in three different streams and a strong research programme leading to Ph.D. in various areas of Civil Engineering. Ten centers of advanced research covering various facets of Civil Engineering, viz., Structures, Hydraulics, Transportation, Geotechnical, Environmental Engineering, Computer Aided Design, Wind Engineering and Remote Sensing, have been established in the Department with assistance from various agencies. The Department also provides consultancy to industries and agencies involved in various kinds of civil works.

1.4.5 Department of Hydrology

The Department of Hydrology came into existence with the inception of International PG course in Hydrology in 1972 with the assistance from UNESCO, Govt. of India & IDRC, Canada. The course aims to award M. Tech. degree in hydrology and to impart training to engineers and scientists from Asia, Africa & other developing countries. In the field of floods, ground water and watershed management, the department has made significant contributions. Some important investigations include hydrological estimates on the failure of Macchu Dam II in Gujarat, design floods of 21 sub-basins of the Sone river, studies on ground water modeling and subsurface drainage studies in command areas of Sardar Sarover and Narmada Sagar projects, respectively.

1.4.6 Department of Management Studies

The MBA programme was launched in 1998 by the Institute to meet the needs of present-day dynamic

business and economic scenario. It takes the onus to prepare a breed of managers who have the courage, skills and resilience to excel in the corporate world.

The MBA at IIT Roorkee is designed to help students to develop essential management skills in leadership and working in teams. At IIT Roorkee, education stretches beyond class room sessions. The emphasis is on creating an environment for students to explore, experiment, discover and realize their potential. A number of activities like Marketing Fair (Consol), National Level Students Paper Presentation Contest (Jigyasa), National Seminar and a bi-monthly in-house magazine (@doms.edu) have been evolved for the students of the Department targeted at developing in them the spirit of teamwork, trust and to create in them the ability to synchronize their individual objectives with the group objectives.

Students also assist the academic coordinator in scheduling all academic activities, test, examinations, faculty evaluation, attendance, discipline, faculty coordination, course restructuring and so on. The Institute has a proven track record of placing its students to the best of organizations.

1.5 ABOUT THE PROGRAMME

A multi disciplinary M.Tech. programme in “*Conservation of Rivers & Lakes*”, with AHEC as the coordinating centre with Deptt. of Hydrology, Deptt. of Management, Civil Engg. Deptt., Chemical Engg. Deptt. & Biotechnology Deptt. as participating departments, is sponsored by MoEF for capacity building of the state, local, central government officers for conservation of water bodies and maintaining the ecology of their systems.

1.5.1 Admission Procedure

There are two ways in which a person can get admitted to the programme.

- As a sponsored candidate
- As a ‘GATE’ qualified candidate

1.6 FINANCIAL INCENTIVES/ OBLIGATIONS

1.6.1 For Indian Nationals Sponsored by Government Agencies

1.6.1.1 The following expenditure would be met by the IITR out of the sponsorship amount of the

National River Conservation Development (NRCD)/ MoEF, among other items:

- A monthly allowance of Rs. 2500/- shall be paid to each candidate. This will be in addition to the salary and allowances that the candidate’s parent organization will be paying to the candidate.
- A one time book expenditure (on approval from faculty supervisor) upto Rs. 5000/- will be reimbursed to each candidate.
- Tuition fee, statutory deposits and hostel fee.

1.6.1.2 Other items

- Mess and other dues will be borne by the candidates directly. (about Rs. 18,000/- annually).
- Hostel/Mess and other facilities will be available as for other candidates of the Institute.
- Married accommodation will be provided only, if available, for which additional charges may be levied.
- The candidates will be entitled to medical facilities as admissible to other M. Tech. students of IITR.

1.6.2 For foreign nationals & Non-Resident Indians

Foreign candidates seeking admission to postgraduate programme should apply through the Govt. of India, if they wish to come through any Govt. supported programmes or under Cultural Exchange Programmes or through Educational Consultants (India) Ltd., New Delhi or any such government/government approved schemes. They may seek necessary help from the Indian Embassy in their country or their Embassy in India. The fee and other expenditure details are given at 4.0. For further details, visit web site: www.iitr.ernet.in.

1.6.2.1 At the cost of Sponsoring Governments/ organisation

Applications of candidates sponsored by foreign governments at their own cost may be made in the prescribed application form and forwarded through the Embassies/Missions of India to the Head, Alternate Hydro Energy Centre, Indian Institute of Technology, Roorkee - 247 667, India.

1.6.2.2 Through Government of India-ICCR scholarships

Some scholarships may be available from ICCR and one needs to apply through Indian missions in host country. Applications in form A2 and A3 (obtainable from Embassies/missions of India in the countries of the candidates) should be sent through Embassies/Missions to Indian Council for Cultural Relations, Azad Bhawan, Indraprastha Estate, New Delhi - 110 002, (Tel. : 91-11-23319309 & 23319310, Fax : 91-11-23378830, 23378639, 23319056, email : dgiccr@iccrindia.org). More details can be seen on www.iccrindia.org/scholarships.htm.

1.6.3 GATE qualified (with Institute Assistance ship and Self financed)

The fee and other financial obligations are to be paid/met directly by the candidates as given separately under 4.0.

1.7 CONSERVATION RELATED INDUSTRIAL CONSULTANCY PROJECTS CARRIED OUT BY AHEC

The projects carried out by AHEC are:

- (i) Assignments projects sponsored by National River Conservation Development (NRCDD), MoEF, Govt. of India and completed:
 - * Draft Working Group Report on Rivers, Lakes and Aquifers in the Environment and Forest Sector for Planning Commission/MoEF-XIth plan.
 - * Review of NRCDD Xth & XIth Plan proposals from states sponsored by MoEF, GOI.
 - * Preparation of Detailed Project Report for Conservation and management plan of Dal-Nagin Lake in Srinagar (J&K)
 - * Preparation of a Vision document of NRCDD's work for 10th Plan and its Restructuring.
 - * Review of Eco-restoration, Conservation and Management Plan of Kodai Kanal Lake in Tamil Nadu.
 - * Review of Eco-restoration, Conservation and Management Plan for Hussain Sagar Lake, Hyderabad.
 - * Preparation of Detailed Guidelines of NRCDD for preparing the Proposals.

- * Evaluation of Works Carried under Yamuna Action Plan (YAP).
 - * Preparation of Detailed Project Report for Conservation and Management of Nainital and 4 lakes in district Nainital.
 - * Review of Water Quality Monitoring Programme Under National River Conservation Programme – NRCDD MOEF, New Delhi
 - * Preparing the status paper on Ganga River sponsored by Ministry of Environment and Forests, Govt. of India
- (ii) Conservation of Mansi Ganga Lake (near Govardhan) for UP Jal Nigam.
 - (iii) EIA of Rural Roads under Improving Rural Infrastructure sponsored by Uttaranchal Government.
 - (iv) DPR for Integrated Sewage & Solid Waste Management of Bhubaneswar city for Government of Orissa.
 - (v) Engineering Services for Execution of Special Works-Nainital Lake.
 - (vi) Preparation of PFR for use of solar, tobacco waste and small hydropower energy sources in ITC factory, sponsored by ITC, Saharanpur.
 - (vii) Emission Control System for Cupolas sponsored by Sterling Co., Agra.
 - (viii) Energy and Environment Auditing of Sugar Mills (Jagraon), sponsored by Jagraon Sugar Mills.
 - (ix) National River Conservation Development Intensive Air Quality Monitoring of Doon Valley for Carrying Capacity Evaluation sponsored by MoEF/NEERI.
 - (x) Conservation and management of River Kshipra sponsored by Ujjain Municipality Madhya Pradesh
 - (xi) Evaluation of Process Designs of 3 offers for 30 MLD STP at Loni, Ghaziabad Based on MBBR Technology sponsored by Yamuna Pollution Control Unit UP Jal Nigam Ghaziabad
 - (xii) Evaluation of Treatment technology for Talwara Colony sponsored by Bhakra Beas Management Board, Talwara Township, District - Hosiarpur
 - (xiii) Development for sustainable basin planning and DSS for MPWSRP For two river basins (Sindh

& Tons) sponsored by MP Water restructuring project

PROJECTS WITH INTERNATIONAL COLLABORATIONS

- * EU Funded research project on “Development of an Assessment System to Evaluate the Ecological Status of Rivers in Hindu-Kush Himalayan Region” with 9 countries co-ordinated by University of Natural Resources & Applied Life Sciences Viena, Australia.
- * Centre for Ecology & Hydrology (CEH) (U.K.) Regime Estimation for Regional Small Hydro Power Assessment
 - Estimation of Low Flows and Verification.
 - International Hydrological Training Programme of UNESCO.
 - Dissemination workshop on REFRESHA.
- * International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal
- * Assessment of River Quality using Biological Indicators of Rivers of Hindu Kush Himalayan Regions- EC funded project.
- * Water and Energy Commission Secretariat, HMG Nepal for small Hydro Projects.

1.8 INSTITUTIONAL FACILITIES

1.8.1 Lodging & Boarding

The Institute provides bachelor’s accommodation to all sponsored students. However, the family accommodation may be provided as & when available.

1.8.2 Club

The students are entitled to become members of the staff/student club of the Institute on payment of membership fee and can avail the facilities of card room & lounge, tennis, squash & badminton court and the television which are available at the hostel. The facilities like Swimming Pool and Cinema of the Institute can also be used by the members of the club.

1.8.3 Mahatma Gandhi Central Library

The library provides necessary infrastructure facilities in the form of books, advanced treatises, works of reference and bibliographical nature, current and back volumes of journals, thesis’s and other kinds of

monographs. It has more than 3.20 lakh volumes to meet the growing and varied requirements of undergraduate and postgraduate students, research scholars, faculty members. The library subscribes to over 8000 electronic journals in all branches of Engineering, Physical Sciences, Bio-sciences and Humanities & Social Sciences available to all computers in the institute. The Library is currently in the process of digitizing its archival collection, thesis and dissertation. The library has also adopted new technologies like VIS, E-mail, CD-ROM workstation and is commissioning a VSAT link for global communication and information through internet.

1.8.4 Information Superhighway Centre

The institute has a star topology Gigabit Ethernet Switch based, state-of-the-art Enterprise network with data, voice and video communication capabilities. The network covers 365 acres of area through 25 km of OFC and 45 km of E CAT 5 UTP, connecting all Departments/ Centres, and Hostels with 24 hours Wi-Fi facility. The Intranet has 2500+ nodes. This facility is being used extensively by the faculty and the students for their educational and research needs and provides an avenue for the exchange of information with other libraries and the centres of research and education.

1.8.5 Other Facilities

Well-equipped hospital, dairy and bakery are available in the campus. A post office as well as branches of the State Bank of India and Punjab National Bank, with foreign exchange facility, are also located in the campus. An Indian Railway Reservation Counter is also located in the Institute Campus.

1.9 ACADEMIC PROGRAMME

1.9.1 Medium of Instruction

The medium of instruction at the Institute is English.

1.9.2 M. Tech. Programme

The M. Tech. Programme comprises of:

1.9.2.1 Courses

The M.Tech. programme consists of two semester teaching and practical work and another two semester for working for seminar, project and dissertation/thesis

on special problems. The teaching includes lectures, and laboratory work. The lectures are supplemented by tutorials and through the writing of concept/review papers and group discussions to illustrate the application of various principles and also to judge the extent to which the ideas have been imbibed by the students. The course has been framed to provide up to date knowledge of basic principles of the subjects. The student can select one/two subject of their choice in second semester depending upon their background & requirements as minor elective from other departments.

The academic session starts from **July/August** each year.

1.9.2.2 Field Trips

The field trips shall be organized to appropriate conservation facilities created for conservation of Rivers & Lakes. Lectures may also be delivered at the sites by local officers connected with the project site. Discussion will be oriented to identification, understanding of and finding solution to various problems encountered at the project site. The students will also be required to prepare study tour reports which will be evaluated during the 3rd semester.

1.9.2.3 Seminar

Every student is required to give presentations in seminar/s on topic/s of his own interest selected in consultation with the participating Departments. The students will be required to collect field data and prepare drawings etc. for proper presentation at the seminar using slides, projectors and computers.

1.9.2.4 Project

Each student shall be required to prepare a project report based on the field data gathered by and/or supplied to him/her for rivers/lakes projects.

1.9.2.5 Dissertation work

Each student will take up dissertation work to fulfill the requirement of M. Tech. degree. The work of dissertation will be on the subject of practical and theoretical importance and will be carried out under the supervision of faculty member (s).

While deciding the Seminar/Project Work/ Dissertation of a candidate, the views, if any, of the NRCD/parent

organization, will also be taken into consideration. A list of project work/dissertation topics will normally be announced by the concerned faculty in consultation with NRCD (Suggestive topics are given at 1.10).

The existing provisions of the IITR enable a candidate to do part time his/her dissertation work (during II year) outside the institute subject to conditions prescribed in this regard. (entirely or in part at the NRCD or the State project sites)

1.9.3 Number of Seats in the Programme

Total number of seats under this programme are.

- a) Candidates sponsored by Indian/State Govt. agencies-10 nos.
- b) Foreign participants and self financed (GATE qualified)-upto 05 nos.
- c) Regular GATE qualified-12 nos.

1.9.4 Eligibility for Admission:

These essential eligibility requirements are applicable to all categories of candidates, viz; regular, sponsored and foreign candidates.

1.9.4.1 For sponsored Indian Nationals :

The candidate seeking admission must possess:

A recognized degree in Civil / Electrical / Mechanical / Industrial/ Chemical/ Agricultural/ Environmental Engineering/ Architecture/ Town Planning or its equivalent with at least **60% marks** or a CGPA of 6.0 on a 10 point scale at the Bachelor's level including AMIE examinations of the Institute or Engineers. **OR Masters of Science with Mathematics at graduation level limited to 30% of total number of seats.**

with

A minimum of **two years** of professional experience in an organization/department /institution dealing in water and/or waste water /environmental engineering, or pollution monitoring/control, or environmental conservation, or management of natural resources, area/ regional/town planning or environmental impact assessment.

1.9.4.2 For direct admission of foreign national & Non-Resident Indians

For **M. Tech. Programme**, the candidates should have

(i) A Bachelor's degree in the above disciplines with a minimum grade point average of 6.75 on a 10 point scale or 60% marks in aggregate (ii) GRE/GMAT scores (iii) Proof of proficiency in English and (iv) Three reference letters.

1.9.4.3 GATE Qualified (Institute Fellowship and Self Financed)

For 'GATE' Qualified Candidates

The admission for such candidates is dealt separately by the Institute for which candidate may see the IITR website www.iitr.ac.in.

1.9.5 Grading of the Students

The students shall be graded for their academic performance on a 10 point grade system as per Regulation in force.

1.9.6 Course Credits and Evaluation

1.9.6.1 Credit (Cr) and Weekly contact Hours

Each course has a number of credits which depend on the academic load and weekly contact hours for Lecture (L), Tutorial (T), Practical (P) and/ or Drawing (D). One Credit is normally assigned to one hour of lecture or two hours of tutorial or practical per week.

1.9.6.2 Performance Evaluation

As per regulations in vogue, the evaluation of academic performance of students is done on continual basis throughout the semester. In the credit and grading system of evaluation, passing and failing is coursewise (Subjectwise). Promotion of a student to the next semester is linked to his obtaining a certain minimum grade point average and his earning of certain minimum number of credits in a semester and up to that semester. The award of degree is also linked with the earning of total number of credits along with other requirements, as specified for each programme.

A student is evaluated for his academic performance through tutorials, practicals, class work, home work assignments, terms papers, field work, quizzes, tests, examination, viva-voce etc. in each semester, as per regulations. Evaluation in every course (subject) is based on weightage of marks/grades assigned to various components as per curricular structure. The components

for evaluation of academic performance are CWS (Class Work Sessional), MTE (Mid Term Examination), ETE (End Term Examination), PRS (Practical Sessional) and PRE (Practical Examination). The marks earned by a student in a course (subject) are converted into letter grades, the value of which is on a 10 point scale.

1.9.7 INTERPRETATION OF IIT REGULATIONS

- (i) Dispute if any, arising out of or relating to any matter whatsoever concerning the admission and/ or academic programme of M.Tech., shall be subject to the exclusive jurisdiction of courts at Roorkee/Uttarakhand State.
- (ii) In case of any dispute or difference of opinion in interpretation of IITR regulations or any other matter not covered in this brochure, the decision of the Chairman, Senate IITR shall be final and binding.
- (iii) Notwithstanding anything contained in the regulations, the Chairman of the Senate IITR may, in emergent situation, take such action on behalf of the Senate, as he deems appropriate and report it to the next meeting of the Senate for its approval.

1.9.8 GENERAL & IMPORTANT

The admission, studentship fee and related matters are subject to ordinances / regulation of the institute in vogue from time to time. Continuation of registration and award of Diploma/Degree etc. are governed by certain minimum academic performance & other regulations of the institute in vogue from time to time. All students shall be governed by ordinances/ regulations in force.

1.9.9 PROCEDURE FOR ADMISSION

Application should be submitted in the prescribed form available in this brochure completed in all respects and duly endorsed by the employing organization/ government. The application may be sent to :

Assistant Registrar (PGS & R),
Indian Institute of Technology,
Roorkee - 247 667, Uttarakhand.
[E-mail: adap@iitr.ernet.in](mailto:adap@iitr.ernet.in),
Tel. : +91 1332-285200, 285098,
Fax : +91 1332-285200, 273560

For any details/information the following may also be contacted:

Head,

Alternate Hydro Energy Centre,
Indian Institute of Technology, Roorkee-247 667,
Uttarakhand.

E-mail : ahec@iitr.ernet.in, aheciitr@gmail.com

Tel. : +91 1332 - 285213, 274254,

Fax : +91 1332 - 273517, 273560

1.10 SUGGESTIVE AREAS AND TOPICS OF DISSERTATION FOR M.TECH. PROGRAMME ON CONSERVATION OF RIVERS & LAKES

1. Performance study of STPs designed on different treatment technologies such as, ASP, WSP, UASB, Oxidation ditch.
2. Suitability and usefulness of advanced sewage treatment technologies such as FAB, MMBR etc. in Indian conditions.
3. Performance evaluation of in use septic tanks and suggesting improvements to make them more effective.
4. Evaluating/Exploring the usefulness of Imhoff's tank technology.
5. Suggesting sewage treatment techniques for hilly towns with population spread over in isolated pockets.
6. Suggesting Decentralized sewage treatment system for a community.
7. Suggesting sewage treatment system for a Group Housing Society having 200 flats.
8. Cost-Benefit analysis of various type of pipes available for laying Gravity sewers.
9. Decentralized Wastewater Treatment Systems (DTS)- it's cost benefit analysis with conventional treatment system, options for reuse of treated sewage, guidelines for incorporation/promotion of DTS in Cist Master Plan/town planning, study of demonstrated DTS units.
10. Low cost sanitation programmes for rural settlements, urban slums.
11. Resource recovery from STPs to reduce O&M costs-utilisation of treated sewage, manure sludge & biogas recovery for power generation/domestic use etc.
12. Nutrient cycle (Nitrogen & Phosphorous) in lakes.
13. Oxygen transfer (DO profile) of lakes and its variation corresponding to organic pollution load.
14. Pollution profile of river for a particular stretch (parameters BOD, COD, TSS, DO, FC, Alkalinity).
15. Environmental Flow: Minimum flow of rivers Ganga/Yamuna pollution abatement.
16. Techno economic comparison of the existing technology vis-vis new technologies for waste water treatment to find out most cost effective treatment technology.
17. Non-point pollution source modeling identifying a particular area.
18. Water Quality modeling for forecasting POPs status in some identified river.
19. Review of status of Lake Conservation Projects in other countries.
20. Approach to Lake Conservation w.r.t. Lakes in urban areas.
21. Evaluation of bioremediation technology used in lake conservation.
22. Evaluation of River Action Plans vis-à-vis the impact as Water Quality.
23. Review of technologies for coliform reduction.
24. Review of indicators of pathogens in water.
25. Technologies for reduction of pathogens vis-à-vis coliform in water.
26. Magnitude of pollution contribution by open defecation.
27. Correlation between application rate of pesticides & fertilizers with their residue in run-off water.
28. Apportionment of capital and O&M cost of sewage & effluent treatment plants.

2.0 M. TECH. IN “CONSERVATION OF RIVERS AND LAKES”

I Semester (Autumn)

Teaching Scheme					Teaching Load Hrs/Week			Exam. Duration (Hrs.)		Relative Weightage (%)				
S. No.	SUBJECT CODE	COURSE TITLE	SUBJECT AREA	CREDITS	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	MA-501F	Numerical Analysis, Probability and statistics	ICC	4	3	1	0	3	-	25	-	25	50	-
2.	AH-521B	Modeling, Simulation and Computer Application	PCC	4	3	1	2/2	3	-	15	15	30	40	-
3.	AH-525	Aquatic Ecology*	PCC	4	3	1	2/2	3	-	15	15	30	40	-
4.	AH-523	Integrated Management of water bodies*	PCC	5	3	1	2	3	-	15	15	30	40	-
5.		Minor Elective-I	MEC	3/4	-	-	-	-	-	-	-	-	-	-
6.		Technical Communication (Optional)	-	2	1	0	2	2	-	15	15	30	40	-
Subtotal				20/23										

*Programme and course title are under review and subject to approval of the Senate.

L= Lecture, T= Tutorial, P= Practical, CWS= Class Work Sessional, PRS = Practical Sessional, MTE= Mid Term Examination, ETE= End Term Examination, PRE = Practical Examination, ICC= Institute Core Course, PCC= Programme Core Course, MEC= Minor Elective Course, PEC= Programme Elective Course

II Semester (Spring)

Teaching Scheme					Teaching Load Hrs/Week			Exam. Duration (Hrs.)		Relative Weightage (%)				
S. No.	SUBJECT CODE	COURSE TITLE	SUBJECT AREA	CREDITS	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	-	Major Elective-I	PEC	4	-	-	-	-	-	-	-	-	-	-
2.	-	Major Elective-II	PEC	4	-	-	-	-	-	-	-	-	-	-
3.	-	Major Elective-III	PEC	4	-	-	-	-	-	-	-	-	-	-
4.	-	Major Elective-IV	PEC	4	-	-	-	-	-	-	-	-	-	-
5.	-	Minor Elective-II	MEC	3/4	3	1	0	3	-	-	-	-	-	-
6.	AH-527	Laboratory Course	PEC	2	-	-	3	-	3	-	50	-	50	-
Subtotal				21/22										

III Semester (Autumn)

Teaching Scheme					Teaching Load Hrs/Week			Exam. Duration (Hrs.)		Relative Weightage (%)				
S. No.	SUBJECT CODE	COURSE TITLE	SUBJECT AREA	CREDITS	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	AH-601	Seminar	SEM	2	-	-	-	-	-	-	-	100	-	-
2.	AH-602	Project and Site Visits	RP	4	-	-	-	-	-	-	-	100	-	-
3.	AH-603	Dissertation*	DIS	0	-	-	-	-	-	-	-	-	25	-
Subtotal				6										

*To be continued and grades to be awarded in the next Semester

IV Semester (Spring)

Teaching Scheme					Teaching Load Hrs/Week			Exam. Duration (Hrs.)		Relative Weightage (%)				
S. No.	SUBJECT CODE	COURSE TITLE	SUBJECT AREA	CREDITS	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	AH-603	Dissertation	DIS	20	-	-	-	-	-	-	-	-	75	-
		Subtotal	20											
		Total	67/70											

Major Electives

Teaching Scheme					Teaching Load Hrs/Week			Exam. Duration (Hrs.)		Relative Weightage (%)				
S. No.	SUBJECT CODE	COURSE TITLE	SUBJECT AREA	CREDITS	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	AH-522	Waste Water Collection, Treatment and Disposal	PEC	4	3	1	-	3	-	25	-	25	50	-
2.	AH-526	Environmental Laws, Public Participation and Institutional Development	PEC	4	3	1	-	3	-	25	-	25	50	-
3.	AH-544	Project Formulation and Implementation	PEC	4	3	1	-	3	-	25	-	25	50	-
4.	AH-548	Coastal Pollution Monitoring and Impact Assessment*	PEC	4	3	1	-	3	-	25	-	25	50	-
5.	AH-550	Application of RS and GIS in Environment Management	PEC	4	3	1	-	3	-	25	-	25	50	-
6.	AH-552	Hydrology and Modeling of water bodies*	PEC	4	3	1	-	3	-	25	-	25	50	-
7.	AH-576	Planning and Management of Environmental Facility*	PEC	4	3	1	-	3	-	25	-	25	50	-
8.	AH-580	Climate Change and water body*	PEC	4	3	1	-	3	-	25	-	25	50	-
9.	HY-527	Ground Water Hydrology	PEC	4	3	1	-	3	-	25	-	25	50	-
10.	HY-531	Water Shed Behavior & Conservation Practices	PEC	4	3	1	-	3	-	25	-	25	50	-
11.	HY-542	Urban Hydrology	PEC	4	3	1	-	3	-	25	-	25	50	-
12.	CE-601B	Environment Impact Assessment of Civil Engineering Projects	PEC	4	3	1	-	3	-	25	-	25	50	-
13.	CE-626	Hazardous Waste and Risk Management	PEC	4	3	1	-	3	-	25	-	25	50	-

Suggestive Minor Electives : The candidates may also choose other minor electives offered in the institute in consultation with the faculty.

Minor Electives

Teaching Scheme					Teaching Load Hrs/Week			Exam. Duration (Hrs.)		Relative Weightage (%)				
S. No.	SUBJECT CODE	COURSE TITLE	SUBJECT AREA	CREDITS	L	T	P	T	P	CWS	PRS	MTE	ETE	PRE
1.	AH-536	Biomass Production & Utilization	MEC	4	3	1	-	3	-	25	-	25	50	-
2.	AH-542	Energy conservation and Management	MEC	4	3	1	-	3	-	25	-	25	50	-
3.	CE-656	Geoinformatics for Land Use/Land Cover Mapping and Analysis	MEC	4	3	-	2	3	-	-	25	25	50	-
4.	HY-538	Hydrology Data Collection Processing and Analysis	MEC	4	3	1	-	3	-	25	-	25	50	-

Existing courses offered for other programmes are shown in *Italic*.

3.0 DETAILS OF COURSE CONTENTS

MA-501F: Numerical Analysis, Probability and statistics

Solution of non-linear equation: Newton-Raphson and a fixed point iteration methods to find roots of non-linear equation(s) in one and two variables; Solution of linear simultaneous equation: LU-decomposition, Crout's method, Jacobi's and Gauss-Seidel iterative methods; Numerical differentiation: Revision of various interpolation formulae, Numerical differentiation using Newton's forward, backward and Stirling's formulae and divided difference; Numerical Integration: Revision of Trapezoidal and Simpson's formulae and Gauss-Legendre Quadrature formulae; Solution of first and second order differential equation: Euler, modified Euler and 4th order Runge-Kutta methods for initial value problems and finite difference approximation methods for two point boundary value problems; Numerical Solution of parabolic and elliptic partial differential equation (i) finite difference methods (ii) and methods of weighted residuals such as collocation, least square and Galerkin's methods; Revision of Concept of probability, Random variable and distribution function: discrete and continuous, moments and moments generating functions; Special distributions (discrete): Binomial, Poisson, Negative binomial, Geometric, Hypergeometric (continuous): Uniform, Exponential, Gamma, Beta, Weibull, Normal, Lognormal, Pearson's; Sampling and sampling distributions; Bivariate distributions, statistical independence, Correlation and regression; Point and interval estimation; Testing of hypothesis; Analysis of variance; Concept of design of experiments

AH-521B: Modelling, Simulation & Computer Application

Introduction to C++, Control Structure functions; Classes and data abstraction; Pointer and Strings inheritance; Virtual function and polymorphism. C++ Stream input/output; Models: Models classifications (Physical, analog and Mathematical); Deterministic, Probabilistic and Empirical models; Transport Phenomena based models (linear & non-linear, Steady state & unsteady state, Lumped parameter & Distributed parameter); Population Balance model; Simulation:

Design of experiments; Experimental simulation and Mathematical simulation; Monte Carlo method based simulation; Numerical Methods used for simulation and exposure to available Computer Softwares; Parameter estimation for models and sensitivity analysis; Water quality modelling, Assimilation capacity, Dispersion of pollutants in water bodies; Case Studies; Modeling of Waste treatment and other pollution mitigation system; Monte Carlo simulation for Risk analysis of conservation of Rivers and Lakes, lake water balance and simulation, modelling for dependable yields from a lake.

AH-525: Aquatic Ecology

Ecology, its relevance to human welfare, sub-divisions, principles and scope; Ecosystems, structure and functions, biotic and abiotic components, productivity and energy flow, cycling of materials, energy efficiency, limiting factors, development and evolution; Trophic levels, food chain and food webs, ecological pyramids, competition, population ecology; Natural and manmade ecosystems; Lakes, wetlands and rivers, reservoirs and springs structure and functions, usefulness; Aquatic Biodiversity: Concept, importance, conservation, Role of invasive species and its importance; System analysis, approach to development of models; Stressed ecosystems, homeostasis, ecological succession, Ecosystem resilience; Pollution of lakes and rivers; Eutrophication, causes, impacts, and control Principles and application of restoration methods, ecotechnologies; National/international perspectives, policies etc. Ramsar Convention, NLCP, NRCDCase histories of Dal Lake, Nainital Lake, Chilka and Loktak wetlands, Asan wetland and Tehri Dam Reservoir, River Ganges and Yamuna etc.; Elementary biochemistry. Salient features of biomolecules. Enzymes and other tools of biotechnology; Microorganisms, discovery and diversity. Prokaryotic cell; Microbial energetics. Biosynthesis and nutrition, Autotrophic way of life. Growth, macromolecular synthesis; Microorganism in its environment, microbiology of water; Bacteria and viruses. Bacteriophages, animal and plant viruses. Structure, replication and quantification; Structure and diversity of algae, protozoa and rotifers;

AH-523: Integrated Management of Water Bodies

Hydrology of water bodies: Types of water bodies, Hydrological processes associated with different water bodies, water balance of water bodies, Estimation of present and projected demands; **Human impacts on water resources/ Water Pollution:** Inventory of human activities in a basin, Land use and potential impact on quality and quantity from Urbanization, Deforestation, Industrialization and Agriculture, domestic demand, Wastewater generation, collection and treatment and disposal, Urban storm water, slum, open defecation, industrial dumps in urban areas, Municipal solid wastes collection, transport and disposal – consequences of dumping in drains or sewer lines; **Water Pollution:** Point & non point sources, Types of water pollution, Water quality criteria & standards, Designated beneficial use; **Water Chemistry:** Equilibrium reactions and Reaction Kinetics, Acid Base Reactions, Oxidation – Reduction Reactions, Precipitation & complexation Reactions; **Water Quality Monitoring:** Sampling, Schedule, Monitoring program of National Rivers and Lakes; Protocol set by NRCDC, case histories of ongoing projects, Quality assurance, Physical, Chemical, Microbiological & Biological Water Quality Parameters/Measures, Standards, Water Quality Indices, Strategy for Water Quality Management; Physical methods of analysis, turbidimetry Nephelometry. Optical methods of measurement, potentiometry, Chromatography, Spectroscopy, a) Measurement of sulphates, Na, DO, BOD, TOC, all forms of N, fluorides b) Exposure to analytical techniques of IIC like ICP, AAS GC etc. c) Biological Components: Periphyton, Phytoplankton, Zoobenthos, Nekton, Biodiversity indices, Trophic status, P/R ratio Microbiological MPN, coliform and streptococcus, Bioindicators, Biomonitoring of water bodies; **Water Bodies and Environment:** Principles of Environmental Management, EIA, Water and sustainable development, involvement of stakeholders, Water governance Environmental education, Public Participation; **Management Techniques:** Application of Remote Sensing and GIS for water management, Modeling (Forecasting & growth modeling) Eco– mapping, Inter river basin transfer, Cost –benefit analysis, Environmental taxes, Economics of Natural Resources; **Legal, institutional framework and governance on water bodies:** Constitutional provisions and national

policies, legal and institutional arrangement for water quality and quantity management,

AH-527: Laboratory Course

Solid waste characterization, Soil Characteristics Permeability, porosity LL, PL, grain size distribution, soil classification and resistivity, Performance evaluation of sewage and effluent treatment plants, disposal of treated solid waste and treated water, possibilities of resource generation on account of generation of biogas and manure, Performance evaluation of toilets, crematoria and river fronts, low measurement techniques: ‘V’ notch, flume etc., Sediment Analysis; Trace element analysis; Performance evaluation of various waste water treatment systems a) Lagoons b) Oxidation Pond c) ASP d) UASB & other treatment plants; Students to work at least for two weeks time at any STP setup under GAP/ NRCDC to carry out the comprehensive evaluation of STPs or ETPs, Demonstration of latest equipment in the laboratory in Institute Instrumentation Centre.

AH-522: Waste Water Collection, Treatment and Disposal

Waste Water Engineering, overview, quality sources and effluent standards, waste load and its evaluation, Flow rates. Water Supply data. Actual measurement, waste water sources, domestic and industrial, analysis of flow data; Natural drainage system and waste water disposal; Waste water collection, sewerage systems and sewage pumping; Typical sewage quality, its composition 7 health hazards of handling and disposal; Software for sewer design and estimating; Waste water treatment objectives, methods and implementation strategy, centralised and decentralised system • Physical operations, screening, grit removal, flow equalisation, sedimentation • Biological processes: Aerobic and anaerobic attached and suspended growth processes. Pond system, combination and / or alternatives • Design of treatment units • Life Cycle Cost; O&M of waste water treatment technologies; Polishing of treated waste water, disinfection, nutrient removal, Natural treatment systems; Treatment of sludge; Disposal of treated effluent & sludge; Resource generation by way of biogas generation, sale of treated water and sludge • Testing treatment • Reuse of treated water in agriculture / horticulture / construction work etc • The CDM of

conservation facilities like STPs, Toilets, crematoria etc. to generate additional revenues

AH-526: Environmental Laws, Public Participation & Institutional Development

Genesis of environmental acts; Main national laws; Water (prevention and control of pollution) Act-1974 and amendments. Title and definitions. Constitution of central and state boards. Prevention and control of water pollution; Water (prevention and control of pollution) rules, CESS act, CESS rules, Environment (protection) act rules 1986 powers of central govt., -Prevention control and abatement of environmental pollution. Hazardous wastes (management and handling rules 1989); Pollution Abatement Policy, 1992; Municipal and solid waste (management and handling) rules 2000. biomedical waste rules 1998 and chemical accidents rule 1998; Environment policies: National Environmental policy (NEP) 2006, Water policy 2002, • EIA Guidelines of MoEF and successive amendments • Biodiversity act 2002 • Latest laws and amendments • Industrial and MSW with rules • Health, safety and environment management system • Water resources management through community participation; Notification of MoEF of July 2005 for construction projects; National Environmental Tribunal Act and Appellate Authority; Environment Audit: Concept and procedure; International Protocol, Treaties and Conventions; Latest International global environmental concepts like global warming and its impact on water resources, Stock-holm Convention and Basal convention, Copenhagen conference; Rio-Earth summit, maintenance of biodiversity, awareness: need, concept & significance; Modes of awareness generation information, education, communication; Costing of awareness generation; Sustainability and impact assessment; Civil Society: Concept and components a) Role of civil society in awareness generation b) Stages of Public Participation c) Forms of Public Participation; Concept and role of Institutions a) Evaluation of existing institutions b) Design of institutions c) Case studies c) Laws related to the institutions

AH-544: Project Formulation & Implementation

Programme and Project objectives; Preparation of reports; PFR, DPR, Cost Estimates; Project

Implementation methods: Self management, Project management and project management agencies; Public hearing process; Tendering procedures: Tender documents of central & different state governments. Standard Tender documents from international bodies like world bank, ADB & other funding agencies. Procedures for developing on-line tendering procedure; Procurement procedure; Internal Rate of Return, Cost Benefit Analysis; Financial Management; Resource mobilization and sustainability of the Project; Project planning - Effective planning, background of network charts, network elements, drawing the network, PERT and CPM comparison and application., monitoring and control; Management concepts: Planning - organizing, staffing, directing and controlling; Use of application softwares in project management • Specific regulations/ statutory acts of other countries not practiced in India • Problems of project implementation: delay in land acquisition, diversion of central funds at state level, litigations to GAP/NRCD; Equipment Development of Lab, identification of appropriate equipment, costs etc.

AH-548: Coastal Pollution and Impact Assessment

Basics of Coastal Surveying: Brief history – Importance – Fields of application of coastal surveying– Fundamental concepts – Survey Planning, Data collection, Data Processing, Data Analysis, Data Quality control, Data Products – Presentation; **Depth determination and Seafloor Feature Detection:** Fundamentals of acoustic wave propagation in ocean waters – Sound velocity computation – Attenuation – Refraction and reflection – Frequency – Band width – Multibeam Echosounders – Feature detection and Sea floor classification; **Water Levels and Flow Measurements:** Principles of Tides and Water Levels – Astronomical Tide Producing Forces – Tidal Characteristics – Non-tidal water level variations – Tide and water level Datum – Harmonic Analysis and Tide Prediction – Principles of Tidal Currents – Measurements and Prediction of Currents; **Biological/ Chemical Indicators of Coastal Pollution:** Methods for the assessment of coastal and marine pollution – Biological productivity and pollution monitoring – Water quality parameters: physical/ chemical/ biological properties, sampling techniques and problems – Nutrients, sewage and anoxia – Impacts of heavy metals – Pathways of radioactivity – Data storage and

processing – Water quality standards; Types of coastal pollution, its causes and concept and guidelines of sewage or sludge disposal into the sea; CRZ notification and environment issues for CRZ clearance with practical case studies, Desalination units for drinking water; **Case Studies:** Case studies of EIA of developmental projects and projects on coastal areas

AH-550: Application of RS & GIS in environment Management

REMOTE SENSING: Definition - Ideal Remote Sensing System-Sensors and Types; Remote Sensing Satellite - IRS and INSAT specifications - Applications of remote sensing - DIP Techniques; GIS: Definition, Components of GIS, Data and Types, Sources of data - Global Positioning System (GPS); **DATA STRUCTURE:** Types of Analysis, Errors, Errors analysis & correction, general Applications of GIS; Environmental Applications of RS and GIS in Optimal Routing of Solid wastes collection system of an urban area. Environmental Siting of Industries and Zoning Atlas Development using Remote Sensing Data and GIS; Re-modelling of Water Distribution & Sewer Network Systems using GIS; GIS for Sustainable Urban Development Planning, Rivers, Lakes and Coastal Areas; Groundwater Vulnerability Modelling using GIS. Environmental Degradation of catchment area, Reservoir capacity,

AH-552: Hydrology and Modelling of Aquatic System

INTRODUCTION - Definition of hydrology. Importance of hydrology. Global water availability. India's water availability. Practical applications of hydrology. Hydrologic cycle (Horton's qualitative and engineering representations); **PRECIPITATION:** Definition. Forms and types of precipitation. Measurement of rain fall using Symon's and Syphon type of rain gauges. Optimum number of rain gauge stations. Consistency of rainfall data (double mass curve method). Computation of mean rainfall (arithmetic average, Thiessen's polygon and Isohyetal methods). Estimation of missing rainfall data (Arithmetic average, normal ratio and regression methods). Presentation of precipitation data (moving average curve, mass curve, rainfall hyetographs, intensity - duration - frequency curves); **LOSSES FROM PRECIPITATION-**

Introduction. evaporation: Definition, Process, factors affecting, measurement using IS Class A Pan. Estimation using empirical formulae; Infiltration: Definition, factors affecting infiltration capacity, measurement (double ring infiltrometer). Harton's infiltration equation, infiltration indices; **RUNOFF:** Definition. Concept of catchments. Water budget equation. Components. Factors affecting. Rainfall - runoff relationship using simple regression analysis, agricultural practices to minimize the impacts of runoff carrying chemicals & pesticides on river ecology; **HYDROGRAPHS:** Definition. Components of Hydrograph. Unit hydrograph and its derivation from simple storm hydrographs. Base flow separation. S - curve and its uses; **STREAM FLOW MEASUREMENT:** Introduction. Measurement of stage. Measurement of discharge by Area — Velocity method and slope area method. Simple stage discharge relation; **RESERVOIR / LAKE SEDIMENTATION:** Introduction. Sediment yield. Reservoir Sediment control. Determination of Sediment Yield at a reservoir site (Using sample recorder); **WATER RESOURCES:** Introduction. Water wealth. River basins and their potential. Importance of water resources projects in India. Need of minimum ecological in rivers, regulations in India & other countries; **RAINWATER HARVESTING:** Introduction. Small scale and small tank harvesting. Urban rainwater harvesting. Methods of ground water recharge; Mechanisms of pollutants mixing: Types of pollutants, The modeling approach, Molecular diffusion in a stagnant fluid, Molecular diffusion equation, Classical solutions of diffusion equation, Advection-Diffusion equation, Some classical solutions of Advection-Diffusion equation, Shear flow dispersion, Taylor's analysis of Turbulent shear flow, Depth and Cross- Section averaging of Advection-Diffusion equation; Vertical mixing: Mechanisms causing vertical mixing, vertical mixing from a steady transverse line source, a steady point source and an unsteady point source • Statistical analysis of water quality; Transverse mixing: Mechanisms causing transverse mixing, Constant-Coefficient Model, Cumulative discharge method for transverse dispersion, Transverse mixing from a diffuser of finite length, Two-Dimensional numerical mixing models; Longitudinal dispersion: Mechanisms causing longitudinal dispersion, Fickian model of longitudinal dispersion, Estimation of mixing length, Analytical solution of

longitudinal dispersion equations, Numerical solutions of longitudinal dispersion equation, Estimation of longitudinal dispersion coefficients, Non-Fickian behavior of dispersion process, Alternative models for longitudinal dispersion; Field measurements of mixing in river and lakes

AH-576: Planning and management of Environmental Facility

EARTHWORK: Volume by cross-section (including prismoidal and curvature corrections), spot levels and contour - construction of mass diagram, calculation of haul, over haul and economic haul lead and lift; **WORKING OUT DATA :** Procedure for working out quantities and rates for the following items - lime and cement mortars, lime and cement concrete, brick and stone masonry, flooring, plastering, RCC works, centering and form works for different RCC items, doors, windows and ventilators; **SPECIFICATIONS-** Drawing up specifications for several construction materials such as coarse aggregate lime, cement, mortars, plain and reinforce concrete, brick masonry, stone masonry, flooring, roofing, plastering, wood work, earthwork and surfing, water supply distribution lines. Surface and sub-surface drainage line (including stone-ware pipes); **ESTIMATION:** Methods of taking out quantities, preparation of detailed and abstract estimates for the following environmental engineering works -Septic tank, manhole, pump house, store room. Calculation for procuring steel for reinforcement for various basic components such as small slabs, chejja and lintels; **FINANCIAL ASPECTS:** Definition, purpose. Cost price - value -different forms of value - gross income - net income - outgoings - types of out goings - obsolescence, annuity, year's purchase; Capital cost, operating cost, capitalized value, time value of money, sinking fund - depreciation - methods of calculation of depreciation, cost fixation on the produced commodity; **FISCAL INCENTIVES FOR ENVIRONMENTAL PROTECTION:** Exemption from IT, Investment and Depreciation Allowance, Exemption from Tax to Capital Gains, Rebate in Cess Levied on Consumption of Water; Measures for Sustainability, Operation and Maintenance of the assets and facilities

AH-580: Climate Change and Water Resources

Carbon Cycle: Natural systems – autotrophs, heterotrophs, energy flows, pre-industrial humanity;

Photosynthesis- efficiency of natural ecosystems, forests and various crops; Respiration, combustion and other oxidation processes; Biomethanation; Climate Science Research: Climate history; Greenhouse gas effect; Anthropogenic climate change; Role of different gases; Global problem; Integrated assessment models; Impacts and adaptation; Uncertainties; Precautionary principle; Carbon Sequestration: Biological pathways; Physico-chemical methods; CO₂ capture from large point sources; Pre-, post- and oxy-combustion technology; Transport, storage and monitoring; Feasibility, economics and public perceptions; Case studies; Water bodies and green house gases; Mitigation measures and adaptation to climate change; Climate Policy: Kyoto protocol; UNFCCC; IPCC; Geopolitics of GHG control; Carbon market - CDM and other emission trading mechanisms; Non-CO₂ GHGs; Relevance for India, procedure for registration for a CDM Projects & its benefit; Case studies

HY-527: Ground Water Hydrology

Water bearing materials, aquifer types & Hydraulic properties of aquifers surface water- ground water ecotone or self purification zone in aquatic ecosystem; Laws of groundwater movement & well hydraulics; Use of tracer techniques in groundwater hydrology; Groundwater flow in ditches & galleries tapping different types of aquifers; Analysis of Test pumping data for various conditions & deviations; Evaluation of well loss parameters; Well drilling, development & design; Methods of artificial groundwater recharge; Groundwater Management by conjunctive use; Groundwater Assessment & Balancing; Seawater intrusion in coastal aquifers; Ground water modeling; Planning for regional groundwater development • Formulation of rainwater harvesting and incentives/ subsidies offered by state Govt. • Institutional framework to prevent over exploitation of ground water • Ground water contamination and remediation techniques

HY-531: Watershed Management

Watershed behaviour – Physical elements of watershed, effects of land use changes on hydrological cycle component; Concept of vegetative management of water yield and quality; Watershed experiments, extrapolation of results from representative and experimental basins, regional studies; Inventory techniques for precipitation

runoff, soil timber, range-land and wild life; Water harvesting techniques-element, development of modern harvesting techniques; Estimation of peak runoff rate; Land capability classification; Erosion process-factors affecting erosion, types of erosion, assessment of erosion control measures for erosion; Conservative practices-objectives and general practices, land and soil classification, identification of critical areas.

HY-542: Urban Hydrology

Process of urbanization and influence on hydrologic cycle; Rainfall analysis in Urban environment; Urban Runoff computations: Empirical, Rational formulae, Time-area and unit hydrograph approaches; Urban drainage: Kinematic wave theory approach; Urban water supply : Estimate of demand, sources in surface and ground water, Reservoir capacity estimation; Introduction to urban watershed softwares Hydrologic Cistern, water conservation and ecological aspects; Water harvesting

CE-601B: Environmental Impact Assessment of Civil Engineering Projects

Introduction to EIA, Definitions; Procedure and People involved; Elements of EIA, Environmental attributes—Air, Water Noise, Land Economic; Cultural and detailed discussions of individual parameters of each attributes; Methodologies for EIA e.g. Adhoc, Network, Matrices, Overlays, WRAM etc; Techniques of analysis; Environmental audit, Modern techniques of EIA; Use of computer; Special issues—Public participation; Case histories for civil engineering projects.

CE-626: Hazardous Waste and Risk Management

Hazardous Waste- Concept and types: Introduction, Classification of Hazardous Wastes, Impact of Hazardous Wastes, Storages and Handling, Treatment and Disposal of Hazardous wastes, Landfilling, Deep Well Injection, Underground Disposal, Onsite and Offsite Management of Hazardous Waste; Risk Assessment: Hazard Identification, Specified Chemical and their Specific health Effects, Dose Response Assessment, Magnitude of exposure, Probability of Health Effects, Exposure Assessment, Monitoring Modelling, Risk Characterisation – Nature and extent of human risk, Epidemiological studies; • Hazardous

chemical and Waste rules • MSDS, risk assessment and consequence analysis • Nuclear radiations

AH-536: Biomass Production & Utilisation

Biomass Resources – biomass production from Agro-forestry, short Rotation Intensive Culture (SRIC) and other practices; Biomass harvesting processing and pre-conversion processes, biomass residues, biomass wastes, biomass from forests, biomass characteristics; Biomass conversion processes : Biological & thermal processes – Anaerobic digestion: Process, biogas plants and their sizing, thermal and electricity from biogas; Biomass briquetting, types of processes, types of machine and applications; Biomass gasification: types of reactors, design parameters, gas purification, thermal and electricity generation applications, fluidised bed gasification; Biodiesel: sources of oil, characteristics, transesterification process for biodiesel production, use as diesel engine fuels; Fermentation: Process, purification of ethyl alcohol, use as gasoline extender in otto engines; Collection, segregation and disposal of MSW for energy production and its over all management; Environmental aspects of biomass energy production & utilization

AH-542: Energy Conservation and Management

Energy Conservation: Energy use pattern and scope of energy conservation, organization of energy conservation programme, Energy monitoring, energy accounting and analysis, energy audit and bench marking, monitoring and targeting; Method for estimation of energy saving potential of fuel and electricity in energy consuming sectors; Energy conservation in boilers, diesel engines. Total Energy System: CHP/ co-generation systems including topping and bottoming cycles. Energy efficient house keepings, waste heat recovery technologies; Illumination; light sources, compact florescent lamp (CFL), light emitting diode (LED), Energy Efficient lighting design, impact of lighting efficiency; Electrical power circuit, energy efficient electrical machines, tariffs and power factor improvements in power system, Energy efficient electric heating system; Thermal energy audit in heating, ventilation and air conditioning (HVAC); energy conservation in pump, compressors, fans, blowers and mechanical drives; Energy savings due to friction, lubrication and thermal insulation; Passing energy conservation: Need and importance of building energy

conservation, energy management of buildings, concept of solar architecture and day light design;

CE-656: Geoinformatics for Land Use/Land Cover Mapping and Analysis

Introduction, Various landuse/land cover classes, Land use information - concepts, definition and its significance. Spatial nature of land use analysis, Land use/land cover classification systems, Spatial resolution requirements, Spectral nature of land use analysis-visible, Infrared, Thermal and radar image, Temporal nature of land use analysis-temporal resolution, Land use change detection, Global land cover monitoring. Manual and Digital image interpretation techniques, Accuracy assessment of land use/land cover classification, Concept of mixed pixel, Sub-pixel techniques for land use/land cover mapping, Linear

mixture modelling, Fuzzy and Neural Network approaches, Land use planning - objectives and planning process. Utility of land use/land cover maps in planning, Various GIS based land use planning systems.

HY-538: Hydrological Data Collection Processing and Analysis

Data collection, processing, storage, transmission and retrieval; Design and optimisation of monitoring systems; Missing data, record extension; Interpolation and krigging techniques; Stage discharge transformation; Analysis of groundwater level and quality data; Analysis of AHS data; Graphical representation of data and results; Trend analysis of hydrological data; Estimation of extremes;

4.0 FEE STRUCTURE

A) For Indian Nationals Sponsored by Government Agencies : No fee. Additional incentives shall also be available as given at 1.6.1.

B) For foreign national and GATE qualified (Institute fellowship and Self financed candidates) following fee shall be payable by the candidates.

S. No.	Items	M.Tech. Programme			Ph.D. Programmes	
		Indian National	Total Cost	Foreign	Indian	Foreign
		Cost per Semester	Total Fees for 4 semester	Cost per Year (US\$)	Cost per Semester	Cost per year (US\$)
1.	Institute fees (As approved by IIT Council)	Rs. 7500/-	Rs. 30000/-	• 2000 for students from SAARC countries	Rs. 10150/-	• 2000 for students from SAARC countries
2.	Mess Advance	Rs. 7500/-	Rs. 30000/-		Rs.7500/-	
	Total	Rs.15000/-	Rs. 60000/-			
	One Time Payment -At the time of admission -Refundable fees Deposit -Yearly fee for group insurance scheme, Bhawan fund -Medical Insurance Fund	Rs. 2790/- Rs. 3000/- Rs. 160/-	Rs. 2790/- Rs. 3000/- Rs. 160/-	• 4000 for students from other countries + 500 one time per programme	Rs. 2790/- Rs. 3000/- Rs. 160/-	• 4000 for students from other countries + 500 one time per programme.
	Fee payable at the time of admission	Rs. 21230/-	Rs. 66230/-		Rs. 280/-	

Note :

- In case of having mess facility, an additional amount of Rs. 2000/- as mess security (Refundable) & Rs. 7500/- as mess advance (per semester) shall be charged from the students.
- The fee may be revised as per MHRD, Govt. of India norms and IIT Roorkee regulations & shall be charged as applicable from time to time.

APPLICATION FORM

Application Form for Admission to Master of Technology
(M.Tech.) Degree programme in "Conservation of Rivers and Lakes".

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE (INDIA)

(Photocopy format may also be used)

1. Name.....
(in Block letters) (Surname) (Middle name) (First name)

2. Father's Name.....

3. Present address.....
.....
.....

Tele. :Fax No.....Mob :

E-mail :

4. Residential address.....
.....
.....

Tele.:Fax No. :Mob:

5. Place of birth

6. Date of birth

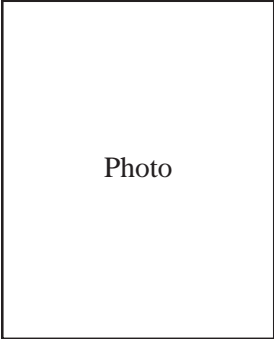
7. Details of Passport : Passport No. : Date of Issue :
(Applicable for foreign nationals only) Place of Issue : Date of Expiry :

8. Marital Status : Married/Unmarried.....

9. Qualification
Academic qualifications* (beginning from High School/Metric)

Name of College University	Degree or Exam. passed	Year	Division with percentage of marks/CGPA	Position/distinction	Main Subjects

*Attach attested photo copies



9. Employment record and Experience:

Name of Employing Department / firm	Position held	Period	Details of work	Remarks

10. Membership of Professional societies.

11. Research work & any other special attainments (Attach additional sheets, if required)

Declaration

I hereby declare that the information furnished above by me is true to the best of my knowledge and belief.

Date :

Full Signature of the Applicant

Place :

Recommended and forwarded:

Approval for nominating the candidate has been obtained from the competent authority.

The officer, if selected to the programme, will be paid salaries and allowances as may be admissible during the period, he pursues his Master's programme at the IIT, Roorkee.

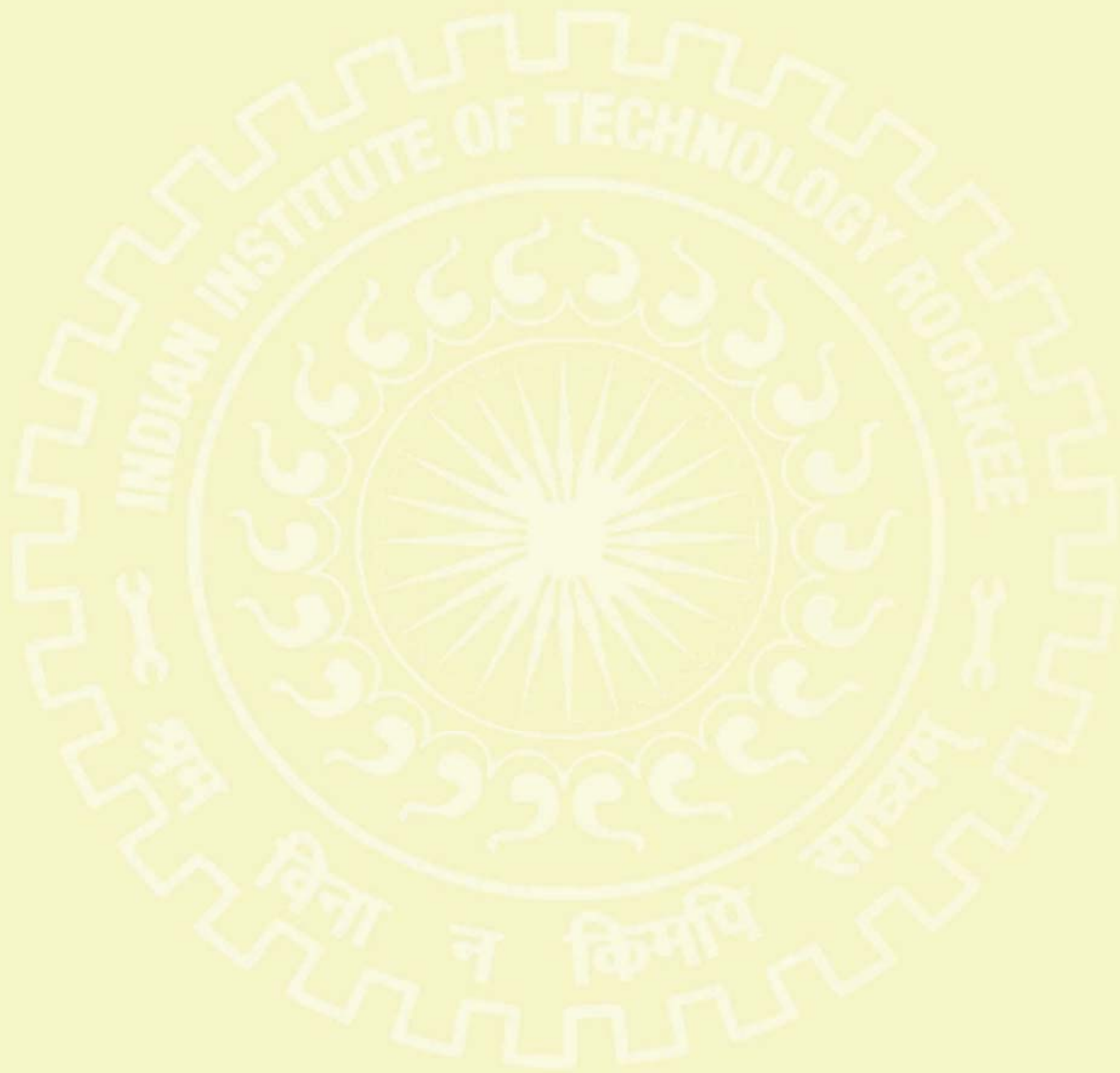
After the candidate has completed the M. Tech. programme, he will be posted on assignments where the skills acquired as a result of his undergoing this programme will be directly used.

Signature, name and designation of the officer forwarding the application

Date :

Name of the employing Organisation
with seal

Place :



For further details, please contact

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