

PROSPECTUS

M. Tech. Programme in Conservation of Rivers and Lakes

Academic Session 2009-2010



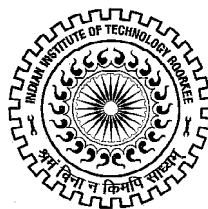
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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

Academic Session
2009-2010

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 157 towns along 31 polluted stretches of major rivers in 18 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 Ministry of Environment and Forests 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 is 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 Indian Institute of Technology, Roorkee (IITR) on September 21, 2001. During the past 160 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 kilometers 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 practising 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 & handled a number of prestigious projects.. These assignments include Environment Impact Assessment of development projects and ecorestoration 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 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. Recently it has set up instrumentation laboratory to provide independent performance testing of small hydro-power 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 I.D.D. 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 Alternate Hydro Energy Centre 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 Ministry of Environment & Forests for capacity building of the state, local, central government officers for conservation of water bodies and maintaining the ecology of their systems.

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 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 Para 4. 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 Assistanceship 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 :

1.7.1 Assignments projects sponsored by National River Conservation Development (NRCD), 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 NRCD 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 NRCD's work for 10th Plan and its Restructuring
- * Review of Ecorestoration, 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 NRCD 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.

1.7.2 Conservation of Mansi Ganga Lake (near Govardhan) for UP Jal Nigam.

1.7.3 EIA of Rural Roads under Improving Rural Infrastructure sponsored by Uttaranchal Government.

1.7.4 DPR for Integrated Sewage & Solid Waste Management of Bhubaneswar city for Government of Orissa.

1.7.5 Engineering Services for Execution of Special Works-Nainital Lake.

1.7.6 Preparation of PFR for use of solar, tobacco waste and small hydropower energy sources in ITC factory, sponsored by ITC, Saharanpur.

1.7.7 Emission Control System for Cupolas sponsored by Sterling Co., Agra.

1.7.8 Energy and Environment Auditing of Sugar Mills (Jagraon), sponsored by Jagraon Sugar Mills.

1.7.9 Intensive Air Quality Monitoring of Doon Valley for Carrying Capacity Evaluation sponsored by MoEF/NEERI.

1.7.10 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 will be entitled to become members of the staff club of the Institute on payment of membership fee and can avail themselves of 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 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 well bound collection of more than 2.75 lakh volumes to meet the growing and varied requirements of its clientele

consisting of undergraduate and postgraduate students, research scholars, faculty members. The library strives to provide physical facilities with calm and cozy atmosphere conducive to study for long hours and subscribes to over 475 current journals in all branches of Engineering, Physical Sciences, Bio-sciences and Humanities & Social Sciences. In addition, 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 acquired INTERNET connectivity through VSAT as well as by optical fibres. 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. Computers are available in the AHEC for use by the students. All students hostels are connected with 24 hour Wi-fi facility.

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:

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 preparation and 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 in to 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) out side the institute subject to conditions prescribed in this behalf. (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 6.75 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.**

Plus

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. 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 course 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/Uttaranchal 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, 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. PROGRAMME TEACHING SCHEME

Scheme of Teaching of Two years duration Interdisciplinary M. Tech. Course in “Conservation of Rivers and Lakes”

Semester-I (Autumn)

Teaching Scheme					Contact Hours Per Week			Exam. Duration (Hrs.)		Relative Weightage (%)			
Sl. No.	Course No.	Course Title	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE
1.	MA-501B	Advanced Mathematics	PG-11	4	3	1	0	3	-	25	-	25	50
2.	AH-521B	Modelling, Simulation & Computer Application	PG-12	4	3	1	2/2	3	-	15	15	30	40
3.	HY-531	Water Shed Behaviour & Conservation Practices	PG-14	4	3	1	0	3	-	25	-	25	50
4.	AH-523	Water Quality Assessment	PG-14	4	3	1	2/2	3	-	15	15	30	40
5.		Major Elective I	PG-14	4				-	-	-	-	-	-
6.		Minor Elective	PG-15	4	3	1	0	3	-	-	-	-	-
		Total		24									

Semester-II (Spring)

Teaching Scheme					Contact Hours Per Week			Exam. Duration (Hrs.)		Relative Weightage (%)			
Sl. No.	Course No.	Course Title	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE
1.	AH-544	Project Formulation and Implementation	PG-13	4	3	2/2	0	3	-	25	-	25	50
2.	AH-526	Environmental Laws, Public Participation and Institutional Development	PG-14	4	3	1	0	3	-	25	-	25	50
3.	CH-524	Environment Impact Assessment	PG-15	4	3	1	0	3	-	25	-	25	50
4.	AH-522	Waste Water Collection, Treatment and Disposal	PG-14	4	3	1	0	3	-	25	-	25	50
5.	AH-525	Ecology and Limnology	PG-14	4	3	1	2/2	3	-	15	15	30	40
6.		Major Elective II	PG-14	4	-	-	-	-	-	-	-	-	-
		Total		24									

Semester-III (Autumn)

Teaching Scheme					Contact Hours Per Week			Exam. Duration (Hrs.)		Relative Weightage (%)			
Sl. No.	Course No.	Course Title	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	PRE
1.	AH-601	Seminar	PG-18	4	-	-	-	-	-				
2.	AH-602	Project and Field Visit	PG-19	4	-	-	-	-	-				
3.	AH-603	Dissertation (To be Continued in IV Semester)	PG-20	12	-	-	-	-	-				
4.	AH-527	Lab Course	PG-13	2	-	-	3	-	3	-	50	-	50
		Total		22									

Semester-IV (Spring)

Teaching Scheme					Contact Hours Per Week			Exam. Duration (Hrs.)		Relative Weightage (%)			
Sl. No.	Course No.	Course Title	Subject Area	Credits	L	T	P	Theory	Practical	CWS	PRS	MTE	ETE
1.	AH-603	Dessertation (continued from III Semester)	PG-20	20	-	-	-	-	-	-	-	-	-
Total				20									

TOTAL

90 credits

Relative weightage of each course may change as per the decision of institute senate in vogue.

MAJOR ELECTIVE SUBJECTS

Sl. No.	Course No.	Course Title	Subject Area	Credits	Contact Hours per Week			Semester
					L	T	P	
1.	AH-542	Energy Conservation and Management	PG-14	4	3	1	-	Spring
2.	AH-546	Advances in Aquatic Ecology	PG-14	4	3	1	2/2	Spring/Autumn
3.	CH-508	Biochemical Engineering	PG-14	4	3	1	-	Spring
4.	CE-524	Solid Waste Management	PG-14	4	3	1	-	Autumn
5.	CE-624	Industrial Waste Management	PG-14	4	3	1	-	Spring
6.	CE-626	Hazardous Waste and Risk Management	PG-14	4	3	1	-	Spring/Autumn
7.	CE-653	Remote Sensing for Land Use Land Cover Mapping	PG-14	4	3	-	2	Spring
8.	CE-553	Principles of Remote Sensing	PG-14	4	3	-	2	Autumn
9.	HY-527	Ground Water Hydrology	PG-14	4	3	1	-	Autumn
10.	HY-537	RS & GIS Application in Hydrology	PG-14	4	3	2/2	2/2	Spring
11.	HY-542	Urban Hydrology	PG-14	4	3	1	-	Autumn
12.	HY-538	Hydrological Data Collection Processing and Analysis	PG-14	4	3	1	-	Autumn
13.	BT-607	Ecology & Environmental Biotechnology	PG-14	4	3	1	-	Autumn/Spring
Any other courses of AHEC, Biotechnology, Chemical Engg., Civil Engg., Hydrology and Management Study may be offered for which guidance will be provided by the Deptt./Centre/Concerned teacher(s).								
Minor Elective Subjects								
1.	BT-615	General Biology & Micro-biology	PG-15	4	3	2/2	2/2	Autumn

3.0 DETAILS OF COURSES CONTENTS

MA-501B Advanced Mathematics(L-3,T-1,P-0)

Numerical Methods : Newton-Raphson and iterative methods for finding roots of a non-linear equation. Cholesky LU-decomposition, Jacobi and Gauss-Seidel method for a system of linear equations. Numerical differentiation. Gaussian Quadrature. Solution of first and second order differential equations using Euler, modified Euler and Runge-Kutta methods Finite difference approximations to two point boundary value problems, Numerical solution of parabolic and elliptic partial differential equations using finite difference approach. Method of weighted residuals. Collocation method of least squares and Galerkins method, Numerical solution of ordinary and partial differential equations using these methods.

Probability and Statistics : Concept of probability, Random Variable, Distribution. Some special distributions such as Binomial, Poisson, Negative Binomial, Geometric, Uniform, Normal, Exponential, Gamma, Beta, Weibull, Log normal and Pearsons. Moments, Moment generating functions. Sampling Techniques, Sampling Distributions. Point and interval estimation. Testing of hypothesis, Analysis of Variance. Concept of design of experiments. Bivariate distributions, Independence, Correlation and Regression.

AH-521B Modelling, Simulation & Computer Application (L-3, T-0, P-2/2)

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; Monto Carlo method based simulation; Numerical Methods used for simulation and exposure to available Computer Softwares; Parameter estimation for models and sensitivity analysis.

Case Studies; Modeling of Waste treatment and other pollution mitigation system; Monto Carlo simulation for Risk analysis of conservation of Rivers and Lakes, lake water balance and

simulation, modelling for dependable yields from a lake.

HY-531 Watershed Behaviour & Conservation Practices (L-3, T-1, P-0)

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.

AH-523 Water Quality Assessment (L-3, T-1, P-2/2)

Types of water pollution, objectives and standards. Water quality criteria. Natural water quality. Sources of water pollution, point and non-point sources. Water quality monitoring, schedules, data generation, quality assurance, data validation, method development and evaluation. Grab, integrated, composite sampling, preservation of samples, expression of results. Fundamentals of Chemistry in water and waste water. Quality characterisation. Importance of quantitative measurements. Standard methods of measurements, volumetric, gravimetric, colorimetric techniques. Physical methods of analysis, turbidimetry Nephelometry. Optical methods of measurement, potentiometry, Chromatography, Spectroscopy. Measurement of turbidity, color, pH, Acidity Alkalinity, Hardness, Chloride and Chlorine residuals, dissolved oxygen, B.O.D., C.O.D., Nitrogen in various forms, solids, Fe and Mn, Trace contaminants phosphorus as phosphates, sulphur as sulphates, fluorides, oil and grease, volatile acids. Biological and Bacteriological parameters, Phytoplankton, Zooplankton, indicator organisms. MPN, MF methods of coliform and Streptococcus measurements. River and Lake pollution. Water quality indices. Case histories of ongoing National Conservation programmes.

Practicals

(a) Measurement of the Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and Total Solids (TS) in water sample. (b) Determination of Chlorides, Total Hardness, Calcium and Magnesium Hardness of the water sample. (c) Determination of Alkalinity and acidity of water sample. (d) Determination of Total Phosphorus. (e) Bacteriological Examination for Total Coliform, Faecal Coliform etc. of sewage and water

AH-526 Environmental Laws, Public Participation & Institutional Development (L-3, T-1, P-0)

Genesis of environmental acts. Main national laws and overview. Water (prevention and control of pollution) Act-1974-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. National Environmental Tribunal Act and Appellate Authority. Environment Audit: Concept and procedure. Case laws principles and statutory interpretations. International Protocol, Treaties and Conventions. Latest International global environmental concepts like global warming and its impact on water resources, Stockholm Convention and Basal convention. Rio-Earth summit, maintenance of biodiversity. Modes of awareness generation-Information, Education, communication. Costing of awareness. 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; d) Laws related to institutions

CH-524 Environmental Impact Assessment (L-3, T-1, P-0)

Environmental Impact Assessment Historical perspective and evolution of guidelines. Development and economic activities and their impact on environmental quality-concept of sustainable development and carrying capacity of environment. Environmental Impact Assessment. Parametric analysis, environmental indices and indicators, operational framework, rapid and comprehensive EIA. Environmental Components-air, water, land, vegetation, wild life, socioeconomic, social development and aesthetics, noise. Environmental domain and its divisions : Base line and impacted valuation and composite impact analysis. Environmental management plan; protective and preventive planning, cost-benefit analysis, disaster management plan and post project monitoring.

AH-522 Waste Water Collection, Treatment and Disposal (L-3, T-1, P-0)

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, 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

Polishing of treated waste water, disinfection, nutrient removal, Natural treatment systems. Treatment of sludge. Disposal of treated effluent & sludge.

Generation of resources and revenues from STPs and ETPs.

Disaster management in the operation and maintenance of treatment plants.

Demonstration: Operation and maintenance of STPs & ETPs.

AH-525 Ecology and Limnology(L-3,T-1,P-2/2)

Ecology, its relevance to human welfare, subdivisions, 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 man-made ecosystems. Lakes, wetlands and rivers, structure and functions, usefulness. Aquatic biodiversity and its importance. System analysis, approach to development of models. Stressed ecosystems, homeostasis, ecological succession. Pollution of lakes and rivers, eutrophication. Conservation and management of lakes, wetlands and rivers. Principles and application of restoration methods, technologies. Catchment rehabilitation, wastewater treatment, biomanipulation, bio-remediation, removal of sediments, aeration, siphoning of hypolimnion, maintaining minimum dependable water flow, flood-plain restoration, use of constructed wetlands for upgrading water quality, improvement in hydrology, selective use of weed removal, stabilisation of shores. National/international perspectives, policies etc. Ramsar Convention, NLCP, NRC. Case histories of Dal Lake, Nainital Lake, Chilka and Loktak wetlands, River Ganges etc.

Practicals:

(a) To determine the pH, Electrical Conductivity and Turbidity. (b) To determine the Fluoride, Phosphorous and Nitrogen and Total Iron. (c) To determine the Oil and Grease content in water sample. (d) To determine the Dissolved Oxygen, BOD and COD. (e) To identify Plankton, phytoplankton, zooplankton and macroinvertebrates. (f) To determine the P/R ratio

AH-527 Laboratory Course (L-0, T-0, P-3)

Solid and liquid waste characterization. Soil characteristics, importance & relevance of waste treatment, sludge characterisation, disposal and solid waste disposal: permeability, porosity LL, PL, grain size distribution, soil classification and resistivity. Leak detection. Flow measurement techniques: 'V' notch, flume etc. Sediment Analysis. Trace element analysis. Performance evaluation of various waste water treatment systems:

(a) Lagoons (b) Oxidation, anaerobic and facultative Ponds (c) ASP (d) UASB & other treatment technologies (e) Continuous evaluation procedure shall be followed.

AH-544 Project Formulation & Implementation (L-3, T-2/2, P-0)

Programme and Project objectives. Preparation of reports; PFR, DPR, Cost Estimates. Project Implementation methods: Self management, Project management and project management agencies etc. Public hearing process. Tendering procedures. Tender documents of central & different state governments. Standard tender document from international bodies like world bank, ADB & other funding agencies. Procedures for developing on-line tendering procedure. Procurement. 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. Effective object planning, background of network charts, network elements, drawing the network, PERT and CPM comparison and application. Use of application softwares in project management. Specific regulations/statuary acts of other countries not practiced in India.

AH-542 Energy Conservation & Management (L-3, T-1, P-0)

Introduction: Organisation of an energy Conservation Program, General principles of Energy Auditing and survey Instrument, Assessment of the technical merits of energy conservation methods

and techniques in specific applications, estimation of cost and potential of fuel and electricity savings as technical options. Energy and power supply technology and systems in residential and tertiary sector, transport sector, industrial sector, electrical utilities—technology and operation, total energy systems-CHP, Energy conservation technologies: transport, fuel efficient engines for transport, industry, heat recovery, process monitoring and control, materials conservation and recycling, buildings heat loss, effect of fabric, ventilation and solar gains, heat recovery, lighting, ventilation and cooling, thermal storage and heat pumps and co-generation: topping Cycles and Bottoming Cycles.

AH-546 Advances In Aquatic Ecology (L-3, T-1, P-2/2)

Brief overview of course, the special properties of water, Living organisms in water, site selection, project design, rapid field bio-assessment protocol, physico-chemical characterization, introduction to sampling gears and their uses ; Rapid field bio-assessment: sample collection and preservation techniques, microbiological analysis, structure and productivity of aquatic ecosystems, the oxygen content of freshwaters and salinity of Inland waters ; Physico-chemical analysis using test kits, Inorganic carbon, the nitrogen cycle, biological samples identification, the Phosphorous Cycle, Iron, sulphur and silica cycles ; The river continuum concept: A model, hydrological characteristics: The hydrological cycle, stream order, fluctuations in flow, the transport of material, the channel, the stream and its valley ; Physical Characteristics: light, current, substrate, temperature, chemical characteristics, biological characteristics, major water quality issues in rivers, identification of samples, calculation of biological indices ; Lake ecosystem concept, characteristics and typology, water quality issues, assessment strategies, calculation and validation of biotic scores and indices, developing water quality maps ; Properties of marine environments, biological components of marine ecosystems, geomorphologic features of marine environments ; Hydrographic features, contrasts of coastal and open water column ecosystems, controls of production and abundance

in coastal environments, Effect of climate change on the worlds oceans and freshwaters, acid rain and freshwater ecosystems, pesticides in water, long range transport of pollutants ; Deliberate modification of rivers, urbanization and its effects on river flow and quality, deforestation and its effects on river flow and water quality, the human impact on lake levels, change in groundwater conditions, water pollution by chemicals from agriculture and other activities, thermal pollution with suspended sediments ; Ecological assessments: Use of benthic algae as indicators of environmental quality, use of macro-invertebrates as biotic indicators of environmental quality, Introduction of Analytical Approaches: Multimetric approach of analysis, multivariate approach of analysis, establishing cause-effect relationships in multi-stressor environments. analysis, establishing cause-effect relationships in multi-stressor environments.

Practicals

(a) Rapid field bio assessment-3 nos., (b) Bio assessment of water quality using bio indicators-3 nos., (c) Assessment of bio indices-2 nos.

CH-508 Biochemical Engineering (L-3, T-1, P-0)

Introduction to Bio-chemical Engineering and Bio - chemistry; Metabolism and energetics; Kinetics of biochemical reactions and microbial fermentation; Heat and mass transfer in biochemical processes, design and analysis of bio-reactors.

CE-524 Solid Waste Management (L-3, T-1, P-0)

Introduction : Development of solid waste mangement, Issues in solide waste management, integrated solid waste management. Sources and types of solid waste:Residential, Commercial and Industrial wastes, Waste generation, Sampling and analysis, Characteristics of solid wastes. Collection and Transport : On site management, (handling storage, analysis of collection system, route optimization, Transfer station, Sorting, Processing and transport, Bailing. Disposal of solid waste. Sanitary land filling, Gas and Leachate Movement

and Control, Design of Land Fills, Natural Attenuation and Containment Land Fills. Composting, Factors affecting composting, Aerobic and anaerobic composting, Design principles. Incineration, Municipal incinerators, Beehive incinerator, Grates, Furnances, Design principles, Pyrolysis of solid waste. Recovery, Recycle and Reuse-Material and Energy recovery operations. Overview of solid waste management practices in India.

CE-624 Industrial Waste Management (L-3, T-1, P-0)

Problem of Industrial Wastewaters. Sampling. Characteristics and variation in quality and quantity of industrial wastes. Indian Standards for disposal of treated wastewaters in natural streams, on land and in municipal sewers, Physico-chemical and biological treatment strategies and their evaluation. Waste surveys. Minimization of industrial waste problem-good house keeping, Equalization, Neutralization, Proportioning, Precipitation, Solid removal, Volume and strength reduction. Process modification including raw materials and chemicals used. Planning of industrial waste treatment and disposal from an industry. Joint treatment and industrial waste with municipal sewage/waste, Paper/pulp, Tannery, Chemicals etc., Industrial waste water treatment.

CE-626 Hazardous Waste and Risk Management (L-3, T-1, P-0)

Hazardous Waste Management: Introduction, Classification of Hazardous Wastes, Impact of Hazardous Wastes, Storage and Handling, Disposal of Hazardous Wastes, Landfilling, Deep Well Injection, Underground Disposal, Onsite and Offsite Management of Hazardous Waste. Risk Assessment : Hazardous Identification, Specific Chemicals 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.

CE-553 Principles of Remote Sensing (L-3, T-0, P-2)

Introduction: Sources of Energy-Active and passive radiation-Electromagnetic Radiation-Nomenclature, Reflectance, Transmission and absorption, Thermal emission-Plank's formula, Stefan-Boltzman law, Wein's displacement law, Emissivity- Kirchoff's law, Characteristics of solar radiant energy, Interaction of EMR with Atmosphere-Scattering, Refraction, Absorption, Transmission, Atmospheric windows, Interaction of EMR with Earth Surface-Spectral reflectance curves, Radiation Calculation, Multi concept of remote sensing, Idealised and real sequence of remote sensing, Platforms and sensors, IRS and ERS satellite systems-Introduction, Stages of development, Sensor characteristics, Orbit and coverages, Various types of data product and their uses. Data processing, Initial data statistics, Pre-processing-Atmospheric, Radiometric and Geometric corrections. Data analysis: Image interpretation: Elements, Keys and aids, Basic instrumentation. Visual analysis of data in Visible, Infra-red, Thermal and microwave regions, Basic concepts of digital image analysis. Application of remote sensing to various engineering fields

CE-653 Remote Sensing for Land Use Land Cover Mapping (L-3, T-0, P-2)

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, Application of GIS in land use planning, Various GIS based land use planning systems

**HY-527 Ground Water Hydrology
(L-3, T-1, P-0)**

Water bearing materials, aquifer types & Hydraulic properties of aquifers, 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 pumping test 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, Sewer intrusion in coastal aquifers, Planning for regional groundwater development.

**HY-537 Remote Sensing and GIS Applications
in Hydrology (L-3, T-2/2, P-2/2).**

Photogrammetry and Photointerpretation, Fundamentals of Remote sensing, Digital image interpretation, Geographical Information System-spatial data bases, coordinate system and georeferencing, digitization, interfacing and digital elevation models, Remote sensing and GIS applications in flood studies, ground water recharge, erosion sedimentation and water quality studies.

HY-542 Urban Hydrology (L-3, T-1, P-0).

Process of urbanisation and influence on hydrological cycle, Rainfall analysis in Urban environment, Urban Runoff computation: Empirical, 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.

**HY-538 Hydrological Data Collection,
Processing and Analysis (L-3, T-1, P-0).**

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.

**BT-607 Ecology & Environmental
Biotechnology (L-3, T-1, P-0).**

Introduction to environment-Ecological principles- Population ecology-Biotic communities Human ecology-Waste water management-Solid waste management-Introduction to biosensors-Bioremediation.

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. Programme	
		Indian National	Total Cost	Foreign	Indian	Foreign
		Cost per Semester	Total Fees	Cost per Year(US\$)	Cost per semester	Cost per year (US\$)
1.	Tuition fees (As approved by IIT Council)	Rs. 5000/-	Rs. 20000/-	<ul style="list-style-type: none"> • 2000 for students from SAARC countries • 4000 for students from other countries + 500 one time per programme. 	Rs.5000/-	<ul style="list-style-type: none"> • 2000 for students from SAARC countries • 4000 for students from other countries + 500 one time per programme.
2.	Institute fees	Rs. 2350/-	Rs. 9400/-		Rs.2350/-	
3.	Hostle fees	Rs. 5500/-	Rs.22000/-		Rs.5500/-	
	Total		Rs. 51400/-			
	One Time Payment					
	<ul style="list-style-type: none"> ✓ At the time of admission ✓ Refundable fees Deposit <ul style="list-style-type: none"> a) Institute caution Deposit b) Library Deposit 	Rs. 2790/-	Rs. 2790/-		Rs.2790/-	
	Fee payable at the time of admission	Rs.5790/-	Rs.5790/-	Rs.2000/-	Rs.2000/-	
				Rs.19640/-		

- ✓ Rs. 250/- to be paid extra at the time of submission of M.Tech dissertation /thesis.
- ✓ The charges for mess and married accommodation shall be payable separately.
- ✓ Rs.3000/- are to be paid at the time of submission of Ph.D Thesis.

- Note :**
1. In case of having mess facility, an additional amount of Rs. 2000/- as mess security (Refundable) & Rs. 6000/- as mess advance (per semester) shall be charged from the students.
 2. 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

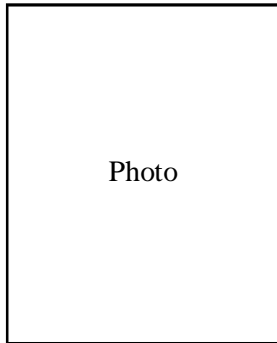
6. Date of birth

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.

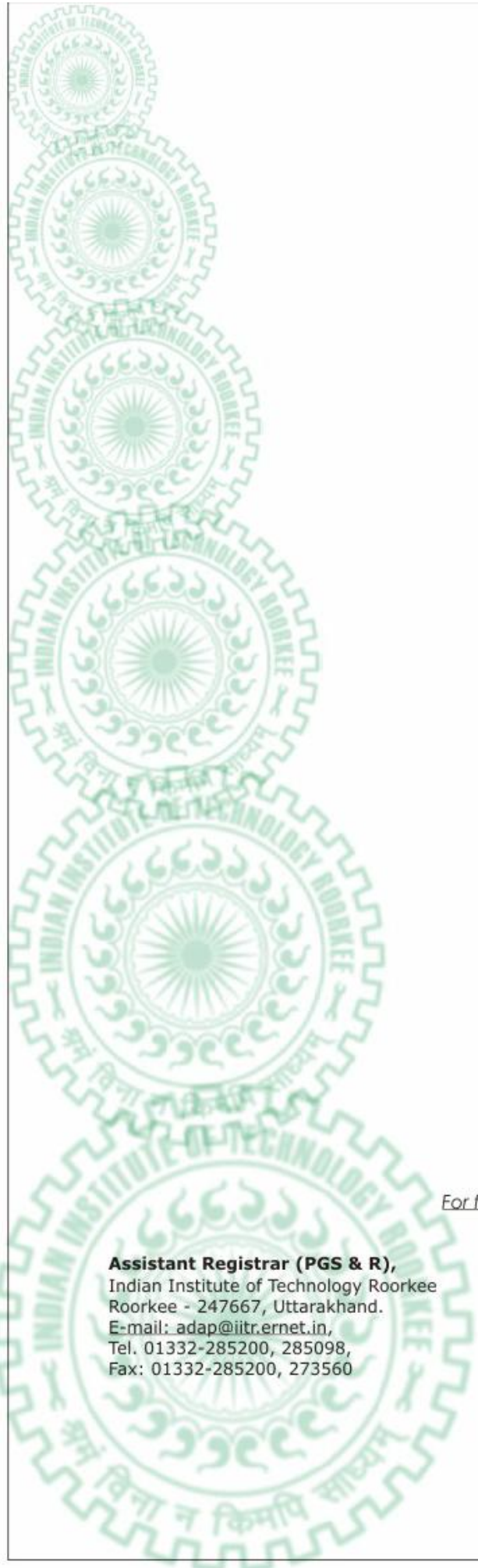
After the candidate has completed the M. Tech. programme, he will be posted on assignments where the skills acquired as a result of his undergoing this programme will be directly used.

Signature, name and designation of the officer forwarding the application

Date :

Name of the employing Organisation
with seal

Place :



For further details, please contact

Assistant Registrar (PGS & R),
Indian Institute of Technology Roorkee
Roorkee - 247667, Uttarakhand.
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