

10. Doctor of Philosophy (Ph. D.) Programmes

10.1 Courses of Doctoral Studies

Table 10.1 shows the various doctoral programmes (by research) in various disciplines in Science and Technology. Apart from original research, all Ph.D. programmes have a course work component effective from September 2009.

TABLE 10.1: DOCTORAL (Doctor of Philosophy) DEGREE COURSES

No.	DEGREE	COURSE
1.	Ph. D. (Tech.) in Chemical Technology	Bioprocess Technology
2.		Chemical Engineering
3.		Dyestuff Technology
4.		Fibres and Textile Processing Technology
5.		Food Biotechnology
6.		Food Engineering and Technology
7.		Green Technology
8.		Nanotechnology
9.		Oils, Oleochemicals & Surfactants Technology
10.		Pharmacy [@]
11.		Pharmaceutical Technology
12.		Polymer Engineering and Technology
13.		Surface Coating Technology
14.		Plastic Engineering
15.	Ph. D. (Tech.) in Technology	Civil Engineering
16.		Electrical Engineering
17.		Electronics Engineering
18.	Mechanical Engineering	
19.	Ph. D. (Sci.)	Biochemistry
20.		Biotechnology
21.		Chemistry (Inorganic/Organic/Physical)
22.		Food Science
23.		Mathematics
24.		Physics
25.		Textile Chemistry

Intake Capacity: There is no prescribed intake capacity for any of the Doctoral courses/ branches since the number of available fellowships and the requirement by the research supervisors varies every year. Several research projects, either funded by various government agencies or private industries, have provisions for fellowships. No admission to a Ph.D. course is done without fellowship, although the amounts vary depending on the source of funding and the candidate's qualifications.

[@] **Ph. D. (Tech) in Pharmacy** is offered in four different branches: (i) Pharmaceuticals, (ii) Pharmaceutical Chemistry, (iii) Pharmacology and (iv) Pharmacognosy. Candidates shall fill up a single form for all these courses. Separate written tests will be conducted for each of the above branches. Candidates may appear for written tests in one or more of these and a separate merit list will be prepared for each.

- Candidates admitted to **Ph.D. (Tech.) in Chemical Technology (Sr. No. 1 - 14)** conduct research under the recognized faculty from the Department of Chemical Engineering, all Departments of Chemical Technology, DBT-ICT Centre for Energy Bio-sciences and ICT-DAE Centre for Chemical Engineering Education & Research.
- Candidates admitted to **Ph.D. (Tech.) in Technology (Sr. No. 15 - 18)** conduct research under the recognized faculty from the Department of General Engineering.
- Candidates admitted to **Ph.D. (Sci.) in Biochemistry (Sr. No. 19), Biotechnology (Sr. No. 20), Chemistry (Inorganic/Organic/Physical) (Sr. No. 21)** conduct research under the recognized faculty from the departments which include Department of Chemistry, Department of Chemical Engineering, all Departments of Chemical Technology, DBT-ICT Centre for Energy Bio-sciences, ICT-DAE Centre for Chemical Engineering Education and Research.

- Candidates admitted to **Ph.D. (Sci.) in Food Science (Sr. No. 22)** conduct research under the recognized faculty from the Department of Food Engineering & Technology. **[See Section 10.3.1]**
- Candidates admitted to **Ph.D. (Sci.) in Mathematics (Sr. No. 23)** conduct research under the recognized faculty from the Department of Mathematics.
- Candidates admitted to **Ph.D. (Sci.) in Physics (Sr. No. 24)** conduct research under the recognized faculty from the Department of Physics.
- Candidates admitted to **Ph.D. (Sci.) in Textile Chemistry (Sr. No. 25)** conduct research under the recognized faculty from the Department of Fibres & Textile Processing Technology. **[See Section 10.3.1]**

10.2 Fellowships for Doctoral Programmes

10.2.1 UGC-SAP Meritorious Fellowships for Ph.D. Programmes:

The Empowered Committee of the UGC has taken several innovative steps to encourage Science and Technology research and building of infrastructure in Universities and Colleges. Thus, UGC has been providing these fellowships to all Departments recognized under Special Assistance Programme (SAP) or non-SAP Departments. The number of fellowships sanctioned by UGC for a particular department depends on its track record of producing Ph.D.s, number of publications in peer reviewed journals, and the SAP status. Those qualified with a GATE/ GPAT score receive fellowship with HRA, whereas non-GATE students get a consolidated amount.

1. 20 **UGC-SAP** fellowships in Department of Chemical Engineering
2. 15 **UGC-SAP** fellowships in the Centre for Physico-chemical Aspects of Textiles, Fibres, Dyes and Polymers to be distributed among the Dept. of Fibres & Textile Processing Technology and Dept. of Dyestuff Technology).
3. 15 **UGC-SAP** fellowships in Department of Food Engineering & Technology
4. 15 **UGC-SAP** fellowships in Department of Pharmaceutical Sciences & Technology
5. 10 **UGC-SAP** fellowships in Department of Chemistry
6. 05 **UGC-SAP** fellowships in Department of Polymer and Surface Engineering
7. 02 **UGC-Non-SAP** fellowships in Department of Oils, Oleochemicals & Surfactants Technology
8. 15 **UGC-SAP** fellowships for Green Technology (with University of Mumbai)

10.2.2. Inspire Fellowship from Department of Science and Technology, Govt. of India:

First Rank holders in Bachelor's degree or Master's degree in Engineering/ Technology/ Pharmacy of any UGC/ AICTE recognized Indian University or Institute/ Statutory Body in India can apply for award of INSPIRE FELLOWSHIP, a scheme of the Government of India to avail research grants for a period of five years for doing research leading to Ph.D. (Tech.) degree. The Bachelor's degree holders with INSPIRE FELLOWSHIP need to register for Integrated Ph.D. (Tech.) degree from the beginning of the research. Application format and necessary documents for application are available on the website www.inspire-dst.gov.in. Eligible candidates may even apply directly to DST and after getting provisional acceptance, they may be considered for admission at ICT, subject to fulfillment of other criteria including institutional entrance tests.

10.3 Eligibility Criteria for the Admissions:

10.3.1. A Eligibility Criteria for Admission to Ph.D. (Tech.)/ Ph.D. (Sci.)

- For **Ph.D. (Tech.)** courses at Sr. No. 1-14 in Table 10.1, the candidate must have passed the Master's degree examination in the Chemical Engineering / Chemical Technology (any branch at ICT)/ Pharmacy/ Plastic

Engineering of ICT or any other UGC recognized University as equivalent thereto with First Class [60% marks or equivalent CGPA (55 % marks in case of reserved category or equivalent CGPA)].

- For **Ph.D. (Tech.)** courses at Sr. No. 15-18 in Table 10.1, the candidate must have passed the Master's degree examination in Civil/ Electrical/ Electronics/ Mechanical/ Production/ Industrial/ Instrumentation Engineering from any UGC recognized University as equivalent thereto with First Class [60% marks or equivalent CGPA (55 % marks in case of reserved category or equivalent CGPA)].
- For **Ph.D. (Sci.)** courses at Sr. No. 19-21, 23 and 24 in Table 10.1, the candidate must have passed the Master's degree examination in the respective faculty of Science of any University recognized by UGC with minimum of 55 % marks or equivalent CGPA (50 %marks or equivalent CGPA for reserved category).
- For **Ph.D. (Sci.)** course at Sr. No. 22 in Table 10.1, in Food Science the candidate must have passed the M. Sc. examination in Food Science, Agricultural Science, other allied fields like Dairy Science, Sugar, other Food Commodity Sciences, Post-Harvest Technology, Food Processing, Nutrition and Home science of any University recognized by UGC with minimum of 60 % marks or equivalent CGPA (55 % marks or equivalent CGPA for reserved category).
- For **Ph.D. (Sci.)** course at Sr. No. 25 in Table 10.1, in Textile Chemistry, the candidate must have passed the M. Sc. examination in Textile Chemistry/ Textile Clothing/ Life Sciences/ Biochemistry/ Microbiology/ Chemistry of ICT or of any University recognized by UGC with minimum of 60% marks or equivalent CGPA (55 % marks or equivalent CGPA for reserved category).
Further, candidates from any of these streams must clear the written test and interviews of the institute which are based on the syllabus of M.Sc. (Textile Chemistry).
- The candidates who have passed the Master's degree by Research of any University recognized by UGC may be considered for admission only if they hold fellowship from any recognized funding agency.
- In addition, the candidates must undergo institutional written test and interview to qualify for admission through merit.
- The candidates qualified in NET/ GATE/ GPAT/ CSIR/ DBT/ – JRF examinations or other equivalent examinations and holding valid fellowship will be preferred.

Apart from regular full time on- campus candidates, following candidates are also eligible to take admission to Ph.D. (Tech.)/ Ph.D. (Sci.):

- (i) Permanent full time teachers of College/ Institute (See **10.3.1.B** for details)
- (ii) Employees of National laboratories/ Government Institutions (See **10.3.1.C** for details)
- (iii) Employees of Industry (See **10.3.1.D** for details)

NOTE:- The selection of all the candidates for Ph.D. (Tech.) including GATE/ GPAT- JRF qualified candidates shall be based on the score in the qualifying examination, performance in the written test and interview (if short listed in written test) conducted by the Institute. However, Persons qualified in NET/ CSIR/ DBT–JRF and holding valid fellowship are exempted from the Written Test.

These rules also apply to the candidates who conduct research on sponsored projects (Govt. or Private) leading to a degree.

10.3.1. B Eligibility Criteria for Teachers for admission to Ph. D. (Tech.) / Ph. D. (Sci.)

Following are the requirements in addition to the criteria mentioned under heading **10.3.1. A** above.

- a)** The candidate should be a permanent teacher having full time teaching experience of at least two years in Degree College or five years in Junior college.
- b)** Teachers who have been in the service of any Engineering and Technology College approved by the UGC/ AICTE are entitled for registration for Ph D. (Tech.) with the faculty of the ICT.

- c) Teachers who have been in the service of any Science College approved by the UGC are entitled for registration for Ph D. (Sci.) with the faculty of the ICT.
- d) The college management should undertake the responsibility of releasing the candidate for course work, experimental work or discussions with the concerned research guide from time to time. A proper time table should be prepared by the concerned teacher and his supervisor, which will be approved by the Head of Department/ Centre Co-ordinator. A bond in this regard should be signed and approved by the Vice Chancellor, ICT.
- e) Teachers can work in the ICT laboratories during vacations and holidays and after their office hours if they come from colleges in the city or nearby. They must indicate on which date they will avail of the research facilities in ICT. A proper log book must be maintained by the candidate duly signed by his supervisor which will be authenticated by the Head of Department/ Centre Co-ordinator.
- f) A maximum period of 5 years extendable by 1 year will be allowed in case of teachers who carry out research part time but put in at least 3 months full time work in a year in the ICT labs. In such cases, part of the experimental work could be allowed to be done in their premises for which their management will provide them with necessary facilities. The characterization and other sophisticated analysis must be done in ICT. Exclusive theoretical work should be discouraged as much as possible to give the teachers a hands-on experience and to bring them into an environment of research. However, this will be left to the individual supervisor's discretion, who should take abundant precaution to avoid unethical practices.
- g) The registered candidates will be required to publish or patent some part of their work within two years of the registration otherwise this registration will not be continued. The publication must be done in peer reviewed international journals. Multi-authored papers without much input from the teacher should be avoided. Conference proceedings which are not peer reviewed will not be considered as publications.
- h) Teachers registering themselves as Ph.D. student of ICT should not register any Masters students with themselves in his/her own college to avoid research by proxy. The candidate as well as his/her supervisor must give an undertaking, with a counter signature of the concerned principal to this effect to avoid degeneration of this novel concept into a Ph.D. by unscrupulous means.
- i) If the teacher intends to join the ICT on leave without pay for a period of three years, then the candidate may be eligible for the UGC fellowship under our SAP programme, provided he/ she successfully clears the Institutional entrance tests.
- j) All regular admissions criteria are applicable to these candidates and they must also do the course work required for Ph.D. programme.

10.3.1. C Eligibility Criteria for Candidates Working in National Laboratories/ / Government Institutions for Admission to Ph. D. (Tech.) / Ph. D. (Sci.)

Following are the requirements in addition to the criteria mentioned under heading **10.3.1. A** above.

- a) The candidate should be a permanent employee working in National Laboratories/ Government Institutions having minimum 2 years of service.
- b) The management of the organisation should undertake the responsibility of releasing the candidate for course work, experimental work or discussions with the concerned research guide from time to time. A proper time table should be prepared by the concerned candidate and his supervisor, which will be approved by the Head of Department/ Centre Co-coordinator. A bond in this regard should be signed and approved by the Vice Chancellor, ICT.
- c) Such candidates can work in the ICT laboratories during vacations and holidays and after their office hours if they come from organisation in the city or nearby. They must indicate on which date they will avail of the research facilities in ICT. A proper log book must be maintained by the candidate duly signed by his supervisor which will be authenticated by the Head of Department/ Centre Co-coordinator.
- d) The registered candidates will be required to publish or patent some part of their work within two years of the registration otherwise this registration will not be continued. The publication must be done in peer reviewed international journals. Multi-authored papers without much input from the teacher should be avoided. Conference proceedings which are not peer reviewed will not be considered as publications.

- e) All regular admissions criteria are applicable to these candidates and they must also do the course work required for Doctoral programme.

10.3.1. D. Admission for Industry -sponsored in-house candidates to Ph.D. (Tech.) / Ph.D. (Sci.)

Following are the requirements in addition to the criteria mentioned under heading **10.3.1. A** above.

1. The candidate should have minimum 2 years of industrial experience.
2. Industry should have a well-equipped Research & Development and Quality Control laboratory with at least one Ph.D. employee working in the set up in the relevant area.
3. Industry is required to get recognition from ICT by the following procedure:
 - i. After receiving request from an industry, a Committee appointed by the Vice Chancellor, ICT will make a visit to the industry laboratory. The ICT appointed Committee will consist of Dean (RCRM) as Chairman with a Professor nominated by the Vice Chancellor and the Head of the Department in the area of proposed research.
 - ii. The committee will evaluate the activities and the competence of the R & D of industry following the guidelines of similar to those proposed by DSIR. All the expenses in connection with the visit will be borne by the industry concerned. The ICT committee will make recommendations to the Vice Chancellor, ICT for approval. The industry R & D will be recognized by the approval of the Vice Chancellor, ICT. In case the laboratory is already recognized by DSIR, the visit by ICT committee will not be necessary.
 - iii. Once the R & D laboratory is recognized by the ICT, the industry is required to pay Rs. 5 lakhs for first four years (typical duration of Ph.D. work) and necessary contingency amount of Rs. 50,000/- per candidate per year (in the name of ICT, to be utilized by the Research Guide) for the conduction of the research activity. After four years, the renewal of the recognition will continue by payment of Rs. one lakh per year. Further, the industry should try to get recognition for their R&D set up from DSIR, based on the recommendation of the ICT appointed Committee.
4. During a year, an industry may nominate up to two employees (with required qualification) for registering for the doctoral degree at ICT under the supervision of ICT faculty.
5. The candidate is required to pay all the Ph.D. fees (over and above laboratory eligibility fees) as proposed by the ICT at appropriate time and will not be eligible for any fellowship. Also, the other requirements, like eligibility criteria, qualifying institutional tests, completion of course work, etc. need to be fulfilled by the industry candidate.

10.3.1. E. Rules and Eligibility Criteria for admission to Integrated Ph.D. (Tech.)

Institute of Chemical Technology (ICT) has a proven track record in training high quality manpower and in conducting research in Chemical Engineering, Chemical Technology, Pharmacy and Allied sciences. In view of the need of attracting talented graduates to Research career in Engineering and Technology, and for enhancing the number of quality Ph.D.s, ICT has initiated a programme of Integrated Ph.D. (Tech.) in Chemical Engineering, Chemical Technology. This programme is not available for Integrated Ph. D. (Tech.) in Pharmacy.

The Integrated Ph.D. (Tech.) Degree Programme is designed to identify candidates with strong potential for a career in Research and to Develop Human resources for the India's future needs in Chemical Engineering and Chemical Technology.

The programme has the following objectives:

- (i) To provide avenues for Doctoral degrees to candidates with talent and aptitude for carrying out advanced research and development activities in Technology.
- (ii) To furnish a multidisciplinary, flexible and innovative Doctoral research programme with special emphasis on
 - (a) Acquisition of proficiency in research, knowledge, data generation and analysis, mathematical modelling, and management with sharpening skills in innovative experimental methods and problem-solving capabilities.

(b) Creation of a pool of young talented, dedicated and committed individuals with passion and involvement in pursuing research and development as a career.

(c) Inculcation of attitude, temper and outlook for developing social commitment as well as high level of scientific ethics and integrity.

(iii) To disseminate the new knowledge in the form of publications, patents, theses, seminars and conferences. Efforts will also be made to help the society and the industry and hence the economy of the country.

Selection of candidates:

i. The candidate, applying for the Integrated Ph.D. (Tech.) programme, must have a Bachelor's degree in Chemical Engineering or Chemical Technology with more than 65% marks or equivalent CGPA (60% marks or equivalent CGPA for candidates from reserved category) of ICT or from any accredited or AICTE recognized Engineering and Technology Institute. A valid GATE score is mandatory.

Selection process:

i. The candidates will be selected on the basis of an Institute level written test and an Interview.

ii. The candidate must score a minimum of 50% in the written examination of the Institute to qualify for the interview.

iii. The selection of the candidates shall be strictly on merit and on the basis of performance in the written test and interview conducted by the ICT.

iv. The list of qualifying candidates will be prepared on the basis of marks in written test and Interviews in 70:30 ratio.

Course Work and Registration for Integrated Ph.D. (Tech.):

a) The registration of the candidate of integrated Ph.D. (Tech.) shall be initially for Master's degree in the same discipline until he/she completes the Course work.

b) The candidates will have to complete the course work of Master's degree in the same discipline with a minimum CGPA of 7.0 before change of registration to Ph.D. (Tech.) degree. Since the programme has an objective of developing best human resources in Research, it is essential that the selection of the candidates is done with utmost care. They are also emphasized about successful completion of the course work.

c) The candidate may be permitted to carry the credits of equivalent course, work of at least two semesters, if it is completed in IITs/NIT/HBNI, or any other reputed Government/ AICTE recognized Institution that has signed an MoU with ICT for transfer of credits, provided as the course work is certified by the competent authority of that Institution. Such candidates may be exempted from taking the respective course work required for the Ph.D. (Tech.) programme. These candidates should be encouraged to take 4 audit courses related to their own research topic.

d) Integrated Ph.D. (Tech.) candidates shall first register for Master's degree and only after successful completion of course work for Master's and in the month of April of second year their registration will be changed to Doctoral degree. The certificate for completion of course work will be mandatory for this.

e) The Registration and review of progress of these candidates will follow the same procedures as for other Ph.D. (Tech.) candidates registered in the Institute.

f) Any candidate who completes the course work as specified above and completes minimum of 1 year of Research project will be awarded the Master's degree in respective discipline, if he/she wishes to discontinue further research or fails to acquire requisite CGPA of 7.0 in Master's programme.

g) Candidate having poor performance in the Master's course work (as given above) will not be registered for Ph.D. (Tech.) degree and may be allowed to submit a thesis on the basis of one year of research work to get Master's degree.

h) On successful completion of the entire programme the candidate will be awarded both the degrees, respective Master's and Ph.D. (Tech.) (Dual Degree) at the end of the programme.

- i) Integrated Ph.D. (Tech.) INSPIRE fellows will be given master's fellowship till 31st March of the second year. They will be given Provisional master's degree certificate to become eligible for the Ph.D. (Tech.) fellowship from April, 01 of the second year.

Course Work for Ph.D. (Tech.)/ Ph.D. (Sci.):

As per the UGC directives and the Ph.D. reforms initiated at ICT, following are the rules governing the course work for a Ph.D. degree programme:

1. All candidates registered at ICT for the Ph.D. degree from academic year 1st July, 2009 will have to complete the course work.
2. Every Ph.D. candidate will complete two Credit courses (theory) and three Audit courses (theory) during the entire duration of Ph.D. The total credit points should be minimum 15.
3. All the course work must be completed before submission of synopsis for the thesis.
4. The selection of the credit and audit courses will be by mutual consultation between the Candidate and the Research Supervisor.
5. The candidate can select any courses offered by ICT that he/ she had not undergone earlier at ICT or elsewhere, either as credit or audit courses.
6. The candidate may choose to take the courses at Institute(s) other than ICT, provided there is an MOU signed between the Institute and ICT for transfer of credits.
7. For the audit courses, a minimum 75% attendance is compulsory.
8. Each course instructor will issue an Attendance certificate in a prescribed format to the candidate at the end of the semester on completion of the course.
9. Submission of copies of attendance certificates will be compulsory at the time of submission of synopsis of the thesis for the Ph.D. Degree.
10. The Attendance Certificates for the audit courses will be maintained by candidate and sent to the Academic Office through the Supervisor and Head of the Department at the time of the submission of the synopsis.

10.3.2 Ph. D. Programmes under ICT-DAE Centre and UGC Netowrking Centre in Chemical Engineering

Ph.D. (Tech.) Programme in Chemical Engineering under ICT-DAE Centre for Knowledge Based Engineering

This Ph.D. programme will induct maximum 20 students per year.

In view of the success of the collaborative programme through the Centre for Knowledge Based Engineering (KBE), BARC and IGCAR proposed to enlarge the scope of collaboration by establishing a ICT-DAE Centre for Chemical Engineering Education and Research that will synergize the strengths of both these organizations. ICT has proven track record in training high quality manpower and in conducting research in Chemical Engineering and Technology. On the other hand, BARC and IGCAR have demonstrated over decades their ability to conduct multi-disciplinary, mission oriented R&D leading to a large number of indigenous and innovative chemical engineering processes, equipment and instruments, and technologies. DAE and ICT have entered into MoU to establish the **ICT-DAE Centre for Chemical Engineering Education and Research**, to cover the following activities.

- (A) Instituting an interdisciplinary Ph.D. programme in Chemical Engineering.
(B) Undertaking R&D projects in the areas of common interest and related to nuclear reactor, fuel cycle and advanced technologies.

The ICT-DAE Ph.D. Degree Programme is designed to identify candidates with strong potential for a career in Research and to Develop Human resources for the India's Nuclear Energy Programme. DAE and ICT agreed to jointly work for setting up the ICT-DAE Centre for Chemical Engineering Education and Research for implementing the following objectives:

- (i) To provide avenues for Doctoral degrees to Ph. D. scholars with talent and aptitude for carrying out advanced research and development activities in Science and Technology.

(ii) To furnish a multidisciplinary, flexible and innovative Ph. D. research programme in Chemical Engineering with special emphasis on:

- (a) Acquisition of proficiency in research, knowledge, data generation and analysis, mathematical modelling, and management with sharpening skills in innovative experimental methods and problem-solving capabilities;
- (b) Creation of a pool of young talented, dedicated and committed individuals with passion and involvement in pursuing research and development as a career;
- (c) Inculcation of attitude, temper and outlook for developing social commitment as well as high level of scientific ethics and integrity.

(iii) To evolve a symbiotic relationship between the ICT and DAE Institutions in such a way that it enables the Collaborative Programme to grow and develop, and in turn ensures that research projects of relevance to the objectives of DAE research institutions are integrated with creative and innovative content.

(iv) To select students on the basis of an all-India test and subsequent interview jointly conducted by ICT and BARC/IGCAR.

(v) To promote effective linkages on a continuing basis between ICT, BARC and IGCAR and the Industry for joint research projects and training programmes and other academic activities related to these Institutes. The expertise and experience so gained shall be shared with other Universities in the country at large.

(vi) To disseminate the new knowledge in the form of publications, patents, theses, seminars and conferences. Effort will also be made to help the society and the industry and hence the economy of the country.

The Ph.D. scholars will take up research projects primarily defined by BARC and IGCAR. However, there will be a certain degree of flexibility for selecting research projects outside the areas of relevance to DAE. To take advantage of the excellent laboratory and library facilities at the DAE institutions, the faculty and students will be provided access to conduct experiments and use of the library and computational facilities at the DAE institutions.

The research projects will be defined by the collaboration team, enumerating the work methodology, the components of research to be done at ICT and BARC / IGCAR, the starting point and the end goals and the performance indicators.

1. Selection of candidates:

1.1 Qualifications

a) *Masters degree in Chemical Engineering, Metallurgical and Mechanical Engineering*

The engineering post-graduate candidates should have a good academic record (more than 60 % marks) or equivalent CGPA and above at the graduation /post-graduation level. Although GATE is not essential, qualifying GATE with minimum 85 percentile would be desirable.

b) *Bachelors degree in Chemical Engineering, Metallurgical and Mechanical Engineering*

The engineering graduate candidates should have a good academic record with more than 65 % marks or equivalent CGPA and above at the graduation/ post-graduation levels. The Engineering graduates should have preferably cleared GATE examination with at least 85 percentile score.

c) *M.Sc. degree in Chemistry, Physics and Mathematics.*

The Science post-graduate students should have a good academic record with minimum 65% marks or equivalent grade in graduate and post graduate examinations.

Candidates qualified in CSIR/NET examination will get preference.

(In exceptional cases candidates with B.Sc. qualification and a minimum 70% marks in qualifying examination will be considered for the programme)

d) *DAE employees with above qualifications*

DAE scientists and employees in DAE establishments with above qualifications will be considered only on recommendation from respective DAE establishment's competent authority.

2. Selection process:

2.1 The candidates will be selected strictly by merit on the basis of performance in the all India written test and interview conducted jointly by ICT faculty and DAE experts. External experts can be invited for the interviews.

2.2 The candidate must score a minimum percentage of 50 % in the written examination of the Institute to qualify for the interview.

2.3 The list of qualifying candidates will be prepared on the basis of marks in written test and interviews in 70:30 ratio.

3. Course Work and Registration:

The Details of the course work prescribed to candidates with different backgrounds is given in guidelines separately.

3.1 For post-graduates in Engineering, the rules and regulations of Ph.D. Programme are the same as other candidates pursuing Ph.D. in the Institute. (See 10.3.1 A)

3.2 The Engineering graduates and Post-graduates in Science will initially register for M. Chem. Engg. and M.Tech in Chemical Engineering degrees, respectively, and will have to complete the course work with FIRST class *before applying for transfer of registration* to Ph.D. degree in Chemical Engineering. They will follow the ICT's rules for transfer of registration to Ph.D. degree.

3.3. The Post-graduate candidates in Science qualified in CSIR/NET examination can be considered for the selection without written test. However, they will have to appear for the interviews. On selection they will have to clear the **course work** as prescribed in guidelines for the programme.

Since the DAE programme has an objective of developing human resources in Chemical Engineering, it is essential that the selection of the candidates is done with utmost care. They are also emphasized about successful completion of the course work.

3.4 DAE scientists/engineers with Master's degree holders in Chemical/Mechanical /Metallurgical Engineering disciplines can be considered for admission to the ICT-DAE programme of Ph.D. in Chemical Engineering provided they clear the Institute's entrance examination and interview.

3.5 The candidates with B. Tech./ M.Sc. degree from DAE establishments will be considered for the programme on a case- to-case basis, only if they have completed successfully the DAE-BARC Training School programme and/or completed equivalent course work in other recognized and reputed institutes such as IITs, HBNI, to get sufficient number of credits as prescribed by the Institute for Master's degree course work. These candidates will have to clear the entrance examination and interviews. The DAE candidates may be permitted to carry the credits of equivalent course work if it is completed in reputed Government/AICTE/ICT recognized Institutions, such as IITs, NITs, HBNI, BARC training school, etc. so long as the course work is certified by the competent authority of such Institution. Such candidates are exempted from taking up the course work required for the Ph.D. programme. But these candidates should be encouraged to take audit courses related to their own research topic.

3.6 Only after the successful completion of the course work the candidate's registration for Ph.D. programme will be confirmed. The certificate for completion of Course work will be mandatory for final registration to the Ph.D. degree programme.

3.7 The Registration and progress review of the candidates will follow the same procedures as the other Ph.D. candidates registered in the Institute.

3.8 Any candidate who completes the course work as specified against each category and completes minimum of 1 year of Research project can be considered for award of M. Tech. degree in Chemical Engineering.

Course work- Typical List of subjects to be taken by Science Post Graduates, Engineering Graduates & post-graduates:

Material and Energy Balance Computations	Chemical Reaction Engineering	Momentum Transfer
Industrial and Engineering Chemistry	Biochemical Engineering	Heat Transfer
Generation and Transmission of Power	Advanced Separation Processes	Mass transfer
Electrical Engineering and Electronics	Nuclear Chemical Engineering	Unit Operations
Applied Mechanics and Strength of Materials	Structure - Property Relationships	Engineering Graphics
Process simulation and optimization	Materials Physics and Chemistry	Process simulations
Materials Processing and fabrication technology	Advanced Reactor Engineering	Nuclear chemistry
Classical and Statistical Quantum Mechanics	Statistical methods of analysis	Transport phenomena
Instrumental methods of analysis	Advanced Mass Transfer	Sources of energy
Nuclear Reactor Theory	Radiation chemistry	
Advanced Chemical Engineering Thermodynamics	Project Engineering Management and Economics	

Guidelines for Ph.D. (Tech.) in Chemical Engineering under ICT-DAE Centre

Category 1: B.E. in Chemical Engineering / B.Tech (Chem.Engg.)/ B.Chem.Engg. / B.Tech.(Chem.Tech.) (ICT)

Required Courses:

- (i) Course work for M.Chem.Engg. (credit courses). (to be completed in 2 semesters from the date of admission)
- (ii) 4 Credit courses related to Nuclear Engineering (to be completed in 3 semesters from the date of admission)

Nuclear and Reactor Physics	Chemistry of Radionuclides
Nuclear Chemical Engineering	Material Science in Nuclear Engineering

Category 2: Bachelor's degree in Chemical Engineering + Course work in BARC Training School

Required Courses:

- (i) 4 credit courses including one seminar in Chemical Engineering to be decided by the supervisor and approved by the coordinator followed by PGPC. (to be completed in 2 semesters from the date of admission)
- (ii) If the candidate has completed equivalent course work in reputed and recognized Institute such IIT, the credit transfer can be permitted for the candidates from DAE establishments.

Category 3: Bachelor's degree in any branch of Engineering (Mechanical/Metallurgical) (except Chemical Engineering / Chemical Technology) + Course work in BARC Training School

Required Courses:

8 courses and one Seminar in Chemical Engineering to be decided by the supervisor and approved by the coordinator followed by PGPC. (to be completed in 4 semesters from the date of admission)

Applied Mathematics – I, II and III	Material and Energy Balance Computations
Momentum and Mass transfer	Energy Engineering
Chemical Engineering Operations	Heat Transfer
Chemical Reaction Engineering	Design and Analysis of Experiments

Category 4: Master's degree in Chemical Engineering / Master's degree in Chemical Technology (ICT)

Required Courses:

4 credit courses related to nuclear Engineering (to be completed in 2 semesters from the date of admission)

Nuclear and Reactor Physics	Nuclear Chemical Engineering
Chemistry of Radionuclides	Material Science in Nuclear Engineering

Category 5: M.Tech. Degree in Chemical Engineering from HBNI + Course Work in BARC Training School

Required Courses: NIL

Category 6: M.Tech. Degree in any branch of Engineering (Mechanical/Metallurgical) (except Chemical Engineering / Chemical Technology) from HBNI + Course Work in BARC Training School

Required Courses:

- (i) 5 credit courses and one seminar in Chemical Engineering to be decided by the supervisor and approved by the coordinator followed by PGPC. (to be completed in 2 semesters from the date of admission)

Category 7: M.Sc. Degree in Physics / Chemistry / Mathematics + Course work in BARC Training School

Required Courses:

- (i) 10 credit courses and one seminar in Chemical Engineering to be decided by the supervisor and approved by the coordinator followed by PGPC. (To be completed in 4 semesters from the date of admission)

Category 8: M.Sc. Degree in Physics / Chemistry/ Mathematics

Required Courses:

- (i) 14 credit courses and one seminar in Chemical Engineering to be decided by the supervisor and approved by the coordinator followed by PGPC. The typical courses will be those listed below (**similar to Category 9**) (to be completed in 4 semesters from the date of admission)

Category 9: B.Sc. Degree in Physics / Chemistry / Mathematics

Required Courses:

- (i) Typically 20 credit courses related to comprising of: (to be completed in 4 years from the date of admission)
 - (a) B. Chem. Level courses (Credit courses)
 - (b) M. Chem. Level Courses (Credit courses)

Advanced Momentum transfer	Thermodynamics of Phase Equilibrium
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Advanced Heat Transfer	Advanced Separation Processes
Advanced Mass Transfer	Advanced Reactor Engineering
Advanced Reaction Engineering	

(c) Nuclear Engineering Level courses (audit courses)

Nuclear and Reactor Physics	Nuclear Chemical Engineering
Chemistry of Radionuclides	Material Science in Nuclear Engineering

10.4 APPLICATION PROCEDURE FOR PH.D. COURSES

For admissions at the ICT for all the Ph.D. courses, a candidate should obtain appropriate application form(s) for the course to which he/she is seeking admission; along with Handbook.

(Refer time schedule for each of the following stages displayed on ICT Notice Board and website www.ictmumbai.edu.in)

10.4.1 Step I: Purchase of Application Form

The candidate shall purchase and fill the appropriate application form/s, separate for each course of choice, namely,

- Ph.D. (Tech.) (separate for each course)
- Ph.D. (Sci.) (separate for each course)

The admission form and Handbook will be available for sale at the ICT counter by payment of cash. The fees for application along with Handbook are given elsewhere of this Handbook.

The forms may also be ordered by post or downloaded from the ICT web site, www.ictmumbai.edu.in. The payment, while ordering by post, should include the amount equal to the “**By Post**” amount and be made only by a **Pay Order/DD** of any Nationalized/ Scheduled/ Private Sector Commercial Bank drawn in favour of “**Institute of Chemical Technology, Mumbai**”, payable at Mumbai and it is non-refundable and non-transferable under any circumstances. **Payment by cheque or money order will not be accepted.** The admission form along with a copy of the Handbook will be sent by **Registered Post Parcel**.

10.4.2 Step II: Submission of Application Form

All the relevant entries in the application form must be completed in legible handwriting or may be typewritten. Incomplete forms will be rejected and no correspondence will be made in this regard. **Writing contact details such as Mobile No./ Telephone No. and email address in the application form is essential.**

The duly filled form along with attested photocopies of required certificates to substantiate the claims made in their application form should be submitted, by the last date notified, at ICT counter or sent to the ICT by Post/ Courier, etc. along with a **Pay Order/ DD** of any Nationalized/ Scheduled/ Private Sector Commercial Bank drawn in favour of “**Institute of Chemical Technology, Mumbai**”, payable at Mumbai and it is non-refundable and non-transferable under any circumstances. **Payment by cheque or money order will not be accepted.**

The application form has a tear-off receipt at the bottom with the application number. The receipt should be filled in by the candidate and shall be signed and stamped by the clerk at the counter while accepting the form. **This receipt should be preserved and the application number must be stated for any future correspondence.**

Applications received after the due date will not be considered for generating merit list. ICT is not responsible for the delay occurred by Post/ Courier, etc. Incomplete applications shall be rejected without entering into any correspondence with the applicant.

- The candidates seeking admission at the ICT must submit attested photocopies of all the documents as given in **Table below** along with the application form.
- Attachment of any certificates will not be accepted separately after submission of the application form.
- The candidates belonging to the SC/ ST categories will be required to submit **The Caste Certificate, the Caste/ Tribe Validity Certificate wherever applicable** at the time of submitting the application form, failing which the category claimed, will not be granted and the **candidate will be treated as a General candidate.**

- The candidates shall not attach a copy of any other certificate which is not asked for, such as certificates for participation in sports, cultural activities, etc.
- The photocopies of certificates or documents attached to the application form should be attested by the Principal of the College or Gazetted Officer or Special Executive Magistrate or Head Master of a Secondary School or teaching staff of a Government /Govt. Aided College / Polytechnic not below the rank of a Lecturer.
- If the candidate produces any certificate, which is not in Marathi, Hindi or English language, authenticated Marathi, Hindi or English version of the same, duly attested by a Gazetted Officer shall also be produced.

TABLE 10.3: Documents to be attached with the Application form for Ph.D. admissions

Sr. No.	Type of Candidate	Attested true copies of documents to be attached along with application form
I	All Candidates	1. SSC (Std. X) mark sheet, 2. HSSC (Std. XII) mark sheet, 3. All Mark sheets of Bachelor's Course 4. Bachelor's degree certificate 5. All Mark sheets of Master's Course 6. Master's degree certificate 7. College Leaving / Transfer certificate 8. Industrial/ Teaching experience/ Relieving letter/ Gap Certificate, if any
II	Backward class Candidates belonging to SC/ ST Categories	Caste certificate, Caste/ Tribe Validity certificate, as applicable. (In addition to the documents mentioned in Sr. No. I)
III	Backward class Candidates belonging to VJ/ DT (NT(A))/ NT(B)/ NT(C)/ NT(D)/OBC/ SBC categories (Maharashtra State candidates only)	Caste certificate, Caste/ Tribe Validity certificate, Non Creamy Layer Certificate valid up to 31 st March 2013. (In addition to the documents mentioned in Sr. No. I)

- **Original certificates should not be attached with the application form. However, those must be made available at the time of admission, failing which the admission cannot be granted.**

10.5 Rules and Regulations about Reservation

Reservation in admission for SC/ST categories is applicable to all Ph.D. courses (all branches) as per the Maharashtra government norms.

10.5.1 Caste Certificate and Caste/ Tribe Validity Certificate.

- Caste Certificate:** The candidates belonging to the backward class categories will be required to submit the Caste Certificate at the time of admission, failing which the category claimed will not be granted and the candidate will be treated as a General Candidate.
- Caste Validity Certificate:** The candidates belonging to the SC/ST category will be required to submit the Caste/Tribe Validity Certificate at the time of admission, failing which the category claimed will not be granted and the candidate will be treated as a General Candidate.

10.6 Fees, Concessions, Cancellations and Refund

10.6.1 Fees prescribed:

The candidates admitted in the first year during 2012-13 are required to pay fees per year as shown in following table:

Sr. No.	Fees	Ph.D. (Tech.)/ Ph.D. (Sci.)	
		Open category and SC/ST candidates from 'other than State of Maharashtra'	Reserved Category Candidates from Maharashtra State Only
1.	Tuition fee	Rs.15,000/-	Nil
2.	Development fee	Rs.25,000/-	Nil
3.	Other fees	Rs.10,000/-	Rs. 50/-
4.	Library Deposit	Rs.500/-	Rs.500/-
5.	Student Diary	Rs.300/-	Rs.300/-
6.	Alumni Asso.	Rs.700/-	Rs.700/-
GRAND TOTAL		Rs.51,500/-	Rs.1,550/-
Eligibility fee of Rs. 500/- is applicable to candidates other than ICT students			

The fees such as Development fees and other fees which are not reimbursed by the Govt. of Maharashtra during subsequent years of the course will have to be paid by all the students.

Notes:-

- a) For confirmation of seat allotted, all candidates have to submit Demand Draft/ Pay Order in favour of '**Institute of Chemical Technology, Mumbai**', payable at Mumbai, of appropriate values as shown in above TABLE.
- b) Candidate, who is Domicile of Maharashtra state and belonging to Backward Class category, if admitted, will be eligible for fee concessions as applicable by Maharashtra State rules.
- c) The SC/ST Candidates belonging to 'other than state of Maharashtra' will have reservation in admission only and they will have to pay full fees at the time of admission. They should submit their fee concession claims to their respective state Govt. through ICT office.
- d) Candidates claiming fee concession under Backward Class category shall produce the Caste Validity Certificate at the time of submission of application form. Candidates claiming for fee concession under OBC, SBC, VJ/ DT NT (A), NT (B), NT(C) and NT (D) category shall also produce Non-Creamy layer certificate Valid up to 31st March 2013.
- e) Hostel Fees shall be charged additionally in case of candidates opting for hostel accommodation (the details are given in Section on Hostels).

10.6.2 Library Deposit:

Library deposit received from the students shall be refunded after successful completion of the course or after cancelling the admission. Unless there is any recovery, no deduction shall be made from the Library deposit. However, the amount of Library deposit shall be credited to institute, if the candidate does not apply for refund, within 3 complete financial years after the student actually leaves the institution; or, within 3 complete financial years after the date of successful completion of the course, whichever is earlier.

10.6.3 Reimbursement of Tuition fee:

Candidates claiming concession under the categories of EBC and sons and daughters for teaching and non-teaching staff of primary, secondary and higher secondary schools shall pay entire fee as applicable at the time of admission and subsequently candidates have to apply to the respective authorities for reimbursement of tuition fees. The quantum of reimbursement received by the institute from the concerned authorities shall be disbursed to the candidate.

10.6.4 Cancellation of admission and Refund of fees:

Refund of tuition fee, development and other fees after cancellation of admission secured at ICT.

Candidate who has been admitted to ICT may cancel admission by submitting an application in duplicate, in the prescribed **Pro forma - E** and request for refund of fees. The refund of fees as applicable shall be made in due course of time. It is made clear that such application for cancellations will be considered if and only if the admission has been confirmed by paying the prescribed tuition fee and other fees in full and by submitting all the necessary original documents. Refund shall be made after deduction of cancellation charges as shown below –

SR. NO.	SITUATION	REFUND
1	Request received within 10 days from the date of admission	Entire fee less Rs.1000/-
2	Request received within 30 days from the date of admission	Entire fee less the total fee for one month. (Tuition, development, other and hostel fee)
3	Request received after 30 days from the date of admission	No refund (except Library Deposit)

Note: For calculation of amount on the pro-rata basis, one month shall be treated as one unit.

ALL RIGHTS REGARDING THE ADMISSIONS AT THE ICT ARE RESERVED WITH THE VICE CHANCELLOR, ICT.