

# INFORMATION BROCHURE

(Updated on May 4, 2020)

(Semester I, 2020-2021)

for admission to

**Ph. D., M. Tech., M.S.(R), M. Des. and M. Sc.\* Programmes**

(For Indian Applicants)



**INDIAN INSTITUTE OF TECHNOLOGY DELHI**

**HAUZ KHAS, NEW DELHI 110016**

\* For M.Sc. (Cognitive Science) & M.Sc.(Economics) only. Admission to other M.Sc. programmes is on the basis of JAM.

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## Message to the Applicants from the Dean, Academics

I am very happy to note that you are planning to pursue your postgraduate education, and in particular you are considering IIT Delhi as one of your choices. India is fast emerging as a knowledge economy and in the next decade or so, we would emerge as a major centre for research and technology development. In this context, your decision to pursue post-graduate education would definitely have a significant impact on your long-term career prospects. IIT Delhi with its 29 Ph.D., 40 M.Tech., 13 M.S.(R), 5 M.Sc., 3 M.B.A., and one M.Des. Programmes, offers you extensive choices of specializations. The strength of the Institute is its 600+ highly qualified faculty, due to which it is continuously ranked among the top technical institutions globally.

As you may be aware, IIT Delhi was recently recognized as an Institution of Eminence (IoE) by the Government of India. While this is a great recognition, it is also a great responsibility on all of us and indeed our prospective PG students, to take this Institution to even greater heights. We would like you to consider joining us in this journey.

In the last few years, we have constantly been working towards making our rules, regulations, and policies governing post-graduate education flexible and attractive to potential candidates. I am writing this letter to make you aware of some major policy changes in the last couple of years.

1. At IIT Delhi, most of the academic Departments/ Centres/ Schools offer M. Tech. and Ph.D. programmes, while some of them also offer an M.S.(R) programme. It is possible for a student to switch from one programme to another any time after one semester of joining. For example, a candidate joining an M. Tech. programme can apply for the switch to a Ph. D. programme in the same Department (or even in another eligible Department), after completing 12 credits of courses with a minimum CGPA of 8.0. All his/her earned credits, if relevant to the new programme, can be considered in the new programme as well. Similar flexibility exists for switching between other programmes.
2. In the last year, IIT Delhi has initiated sponsored research activities worth around Rs. 350 crores which are expected to grow further this year. Candidates wanting to gain project experience along with post-graduate education can apply and join one of the sponsored projects simultaneously with admission to the post-graduate degree. Apart from gaining experience, various schemes may provide for higher assistantship amounts with your participation in the sponsored research projects. One significant policy change that has been adopted is that the recruitment for the project can also be carried out by the same Department/ Center/ School Research Committee (DRC/CRC/SRC) that admits students to the postgraduate programmes.
3. IIT Delhi is striving towards ensuring that each of its Ph.D. students has an opportunity to present a paper and attend at least one international conference before they graduate. We offer a certain quantum of financial support to all full-time research scholars to present their research at up to two international conferences.
4. We have also introduced a new scheme under which highly meritorious research scholars are awarded a further opportunity for presenting their work at another conference, provided they have demonstrated sustained excellence in their research.
5. Our post-graduate programmes are highly flexible, which offer students a variety of courses and research topics to choose from.
6. Meritorious students with a bachelor's degree (such as B. Tech.) are advised to directly apply for the Ph. D. programmes if they wish to pursue doctoral research. Details about direct admission to Ph. D. for B. Tech-qualified students are available in this brochure and also on our website. Of course, students who already hold a Master's degree are welcome to apply for Ph.D.
7. Starting this academic year, IIT Delhi is starting two new M.Sc. Programmes – M.Sc. (Cognitive Science) and M.Sc. (Economics). These programmes are being offered by the Department of Humanities and Social Sciences. The detailed eligibility and application process for these courses are given in this information brochure. Please note that admission to the other three existing M.Sc. programmes (Physics, Chemistry, Mathematics) is through Joint Admission Test for M.Sc. (JAM).
8. IIT Delhi is actively promoting post-graduate research in inter-disciplinary areas, and you are invited to avail of this exciting opportunity. In addition to such research being pursued in our regular Academic Units, we also have a School of Interdisciplinary Research (SIRe) wherein candidates with a diversity of backgrounds seek

admission to pursue a Ph.D. degree involving faculty supervisors in different Academic Units and expertise, jointly supervising the student. Please look for more details on inter-disciplinary research on our website.

9. IIT Delhi, as a part of its Institution of Eminence (IoE) initiatives, is moving rapidly to welcome meritorious candidates for pursuing Ph.D. from other countries. As part of this, International students wanting to pursue PhD degree at IIT Delhi (who are not availing a scholarship from any other source) are entitled to a merit-based fellowship under the International PhD Fellowship Programme (IPFP). More information on this scheme and other details for international students are available at: <http://intladm.iitd.ac.in>
10. Starting Academic Year 2020-21, IIT Delhi is also starting a new scholarship scheme for international students wishing to pursue M. Tech. / M. Des. / MS(R), under the newly launched “International Masters Scholarship Programme (IMSP)”. Under this scheme, international students wishing to pursue either of M. Tech., M. Des., or MS(R) degrees in IIT Delhi, and secure an admission offer from the respective Department or Centre or School within IIT Delhi, are entitled to be considered for a limited number of merit-based scholarships. Those international students who have successfully cleared the Graduate Aptitude Test in Engineering (GATE examination: <http://gate.iitd.ac.in/>) are also entitled to a scholarship for pursuing their masters degree in IIT Delhi. More details of on the IMSP scheme are available at: <http://intladm.iitd.ac.in>
11. IIT Delhi is the National Coordinator of two flagship MHRD schemes: the Prime Minister’s Research Fellowship (<https://pmrf.in/>) and the Scheme for students in ASEAN countries to pursue PhD in IITs (<http://asean.iitd.ac.in/>). The latter scheme entitles students from ASEAN countries (<https://asean.org/asean/asean-member-states/>) to pursue PhD with a full scholarship at any of the IITs, including IIT Delhi. Potential PhD candidates from the ASEAN member countries interested in pursuing their PhD degree in IIT Delhi are strongly encouraged to avail this facility.
12. Under the PMRF scheme (<https://pmrf.in/>), Indian students of high merit from who have completed their bachelors degree, or pursuing their masters or PhD degrees in top Indian institutions may be considered for a merit-based premier scholarship. Potential candidates are encouraged to apply under this scheme, and seek details at the website. Further details of the PMRF Scheme, starting in Academic Year 2020-21, will be announced shortly.
13. At IIT Delhi, we are engaged in two Joint Ph.D. programmes, one with University of Queensland, Australia ([www.uqidar.org](http://www.uqidar.org)), and other with National Chiao Tung University, Taiwan ([www.nctu.edu.tw](http://www.nctu.edu.tw)). While for the UQ-IITD programme, the admission is through a separate channel (details on the website [www.uqidar.org](http://www.uqidar.org)), for NCTU the entrance is after the selection of students into the regular IITD Ph.D. programme.

You may wish to note that IIT Delhi has a larger number of students in post-graduate programmes than in undergraduate programmes. All students are equally important to us, but increasingly the Institute’s focus is more towards the research and innovation undertaken by our post-graduate students. We urge you to consider us as your institution of choice to further your goals of getting a higher professional degree.

One point needs some mention. Owing to our rapid growth in recent years, we are facing acute shortage of campus accommodation (hostels). Due to this, some of our students may need to stay outside campus, at least in the initial period of their study in PG programmes at IIT Delhi. IIT Delhi will do everything possible to facilitate the stay outside campus (if necessary). We expect the crunch of hostel accommodation to ease out in the near future, but for now we as a community need to live with the constraints.

There are many more things I would like to share with you once you are selected to our PG programmes and wish to join IIT Delhi. I am looking forward to seeing you in the Orientation Programme scheduled for **August 13**, 2020 with you being accepted for admission in one of your preferred postgraduate programmes. Please note that in view of the evolving situation related to the COVID-19 outbreak, the dates may change. Hence, please keep checking for updates on the IIT Delhi website.

With best wishes,

Prof. Shantanu Roy  
Dean, Academics

## Important Dates

Submission of online application commences on	March 02, 2020 (12.00 noon)
Last date for submission of online application and application fee <sup>#</sup>	<b>May 10, 2020</b> (04.00 pm)
Entrance Test for M.Sc.( Economics)*	To be decided
Range of dates for Test / Interview <sup>\$</sup>	May 18, 2020 - June 17, 2020
Date of Orientation and Registration for new students <sup>\$</sup>	August 13-14, 2020
Commencement of classes <sup>\$</sup>	August 18, 2020

<sup>#</sup> The date has been extended in view COVID-19 outbreak

<sup>\*</sup> The written test that was scheduled for 2 May 2020 has been postponed in view of the COVID-19 outbreak. A new date would be announced later on the applications portal (<https://joaps.iitd.ac.in/hes2020/>) All dates are tentative and may be revised in view of COVID-19 outbreak

## **INTRODUCTION**

Indian Institute of Technology Delhi is one of the seven older established Institutes of Technology in India, the others being Kharagpur, Bombay, Madras, Kanpur, Guwahati, and Roorkee. Recently, Government has set up sixteen more Institutes of Technology. These Institutes have been created as centres of excellence for higher training, research and development in science, engineering, and technology. Established as a College of Engineering in 1961, the Institute in Delhi was declared an Institute of National Importance under the “Institutes of Technology (Amendment) Act, 1963” and renamed “Indian Institute of Technology Delhi”. It was then accorded the status of a University with powers to decide its own academic policy, to conduct its own examinations, and to award its own degrees.

Recently, IIT Delhi has been accorded the status of “Institute of Eminence” by Government of India, one out only three public institutions to have been granted this honour.

The Institute offers undergraduate and postgraduate programmes through its Departments, Centres, and Schools. The Institute admits about 1000 students for the undergraduate (B. Tech.) programmes and about 1900 students for the postgraduate (M.Sc. / M.Tech. / M.S.(Research) / M.Des. / M.B.A. / Ph.D.) programmes every year.

Intellectual alertness, creativity, and talent for innovation go into the making of an engineering leader today and continue to be essential for professional competence tomorrow. The candidates selected for admission live in pleasant surroundings of intellectually stimulating campus, use the most modern equipment and laboratory facilities available, and go through the specialized courses designed to meet the challenges of the future. The teaching methods rely on direct personal contact between the teachers and the students. Living in such an environment with people having similar goals and aspirations is an exciting experience during one’s academic life and is of considerable value in one’s professional career.

**Location:** IIT Delhi is situated at Hauz Khas in South Delhi, bounded by the Sri Aurobindo Marg on the East, the Jawaharlal Nehru University complex on the West, the National Council of Educational Research & Training on the South, and the outer Ring Road to the North. The Institute campus is about 19 km away from the Delhi Main Railway Station, 14 km from the New Delhi Railway Station, 21 km from the Maharana Pratap Inter-State Bus Terminus (Kashmere Gate), 22 km from Indira Gandhi International Airport Terminal 3, and about 10 km from the domestic terminal (Terminal 1) of the Delhi Airport. The campus is well connected through Delhi Metro with two stations opening at its gates – Main Gate and Hostel Gate.

**Campus:** IIT Delhi is a residential Institution and provides residential facilities to as many students and staff as possible, subject to availability. The Institute campus area extends to 320 acres with many interesting topographical features, imaginatively laid out with picturesque landscape, numerous buildings, and wide roads. The campus presents a spectacle of harmony in architecture and natural beauty.

The main academic building houses various teaching, research, and library facilities. Though each Department/ Centre/ School is a separate entity, all the Departments/Centres/Schools together constitute an integrated complex. Most of classes at IIT Delhi take place in the new Lecture Hall Complex (LHC). At the LHC and also in the blocks, lecture theaters with modern amenities and equipment for projection have been located adjacent to two or more Departments for common use. The campus also provides such amenities as staff clubs, hospital, shopping centres, banks, ATMs, post office, community centre, stadium and playing fields.

The Students Activities Centre provides facilities for students’ extracurricular and physical development. The central two-storeyed block with a swimming pool and a gymnasium hall has amenities such as squash courts, hobbies workshop, seminar rooms, music rooms and other multipurpose rooms for reading and indoor games. The amphitheater constructed in modern style is an added amenity at the centre.

## **CREDIT SYSTEM**

Education at the Institute is organized around the credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance, and flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling the minimum requirement for continuation.

Each course has a certain number of credits which describe its weight. A student's performance in a course is assessed by a grade awarded to him/her at the end of the semester for that specific course, based on comprehensive evaluations during the entire duration of the course. The student's overall progress through the programme is measured by the number of credits that he/she has completed satisfactorily. A minimum Grade Point Average (average score based on grades obtained, weighted by the corresponding credits of each course), is required to be maintained for satisfactory progress.

The minimum academic requirements for the various degrees, including minimum and maximum credits to be registered in a particular semester, are indicated in the Courses of Study for the year 2020-2021, which will be made available on the Institute Website before the date of Orientation.

Every course is coordinated by a member of the teaching staff of the Department/ Centre/ School which offers the course in a given semester. This Faculty member is called the Course Coordinator. He/she has full responsibility for conducting the course, coordinating the work of the other members of the faculty involved in that course, and for holding tests and assignments and awarding grades. For any difficulty, a student is expected to approach the Course Co-coordinator for advice and clarification.

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## **ADMISSION PROCEDURES AND REQUIREMENTS**

### **I. Ph.D. Programmes**

The award of the Ph.D. degree is in recognition of high achievements, independent research, and application of scientific knowledge to the solution of technical and scientific problems. The creative and productive inquiry is the basic concept underlying the research work. The details of research programmes in various Departments/ Centres/ Schools are given in **Annexure I**.

**Course work and other academic requirements:** In order to overcome any deficiency both in the breadth and depth of fundamental training or proper foundation for advanced research work, special make-up or pre-doctoral courses are offered by each Department/ Centre/ School. These courses are given either by a faculty member, or by guest speakers and specialists in the profession. Normally, candidates having a B. Tech./ M.Sc./ M.A., or equivalent degree are required to complete a minimum of 12 or 20\* credits (depending on the programme) with a minimum required DGPA of 7.50 and CGPA of 7.00. M. Tech. or equivalent degree holders are required to complete a minimum of 6\* credits with a minimum required DGPA of 7.50 and CGPA of 7.00.

**Admission to the Ph.D. Programmes:** Admission to the Ph.D. programmes is normally made on the basis of an interview of eligible candidates conducted by the Department/Centre/School concerned, through its Department Research Committee (DRC) / Centre Research Committee (CRC)/ School Research Committee (SRC). DRC/CRC/SRC may decide to conduct a written test as well, or multiple interviews, or other ways or testing, in order to screen the candidates. Applications are invited from candidates by advertising the programmes in Employment News/web portals in March for the first semester and in October for the second semester every year. **In view of COVID-19 outbreak, it has been decided by the Senate that conduct of interviews for admission to Ph.D. programme will be done online through videoconferencing.**

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*\*A Department/ Centre/ School may specify a higher credit requirement for all their Ph.D. programmes. It may also require an individual scholar to complete a larger number of credits based on his/her background and preparation level.*

**Admission schedule:** Normally, Ph.D. programmes are advertised in the month of March and October each year, and test/interviews are carried out in the months of May and December. Further, admission to the Ph.D programme is possible at **any time of the year** with the application being processed and candidates interviewed by the respective DRC/CRC/SRC. Ph.D. scholars can join the Institute at any time of the year, though the course registration will be possible only at the beginning of the subsequent semester. Such candidates must also fulfill the required academic qualification/ experience at the time of the interview. They must join the Institute within 4 weeks after the issue of admission offer unless specifically permitted otherwise. Admission is subject to the vacancy being available in the relevant specializations.

**Duration of the programmes:** Minimum period of registration required for students with M.Tech. or equivalent qualifications is 2 years whereas those with B. Tech. or equivalent qualifications is 3 years. All candidates are allowed a maximum of 7 years for submission of their theses.

#### **I(a) Minimum Qualifications for admission to Full-time Ph. D. Programmes:**

Table 1 defines the minimum qualifications required for admission to full-time Ph. D. programmes at IIT Delhi. Please note:

- *These are Institute minimum requirements and any Department/Centre/School operating through their DRC/CRC/SRC can specify higher short-listing criteria than what is specified here.*
- This table includes most of the degrees, but each DRC/CRC/SRC is free to specify the qualifications and disciplines acceptable for admission to their programmes.
- Candidates in the final year of their programmes and who expect to complete all their qualifying degree requirements before the date of registration are also eligible to apply for admissions. For short-listing purposes, their performance until the preceding semester (preceding year if their programmes are year based) would be considered but their admission would be provisional, subject to their meeting the minimum eligibility criteria after their final qualifying examination results are announced. In any case, all admissions are provisional at first and it is confirmed only after all certificates and previous records are duly checked and verified, a process which may take a few weeks into the starting semester.

**Table 1: Minimum Qualification for Admission to full-time Ph.D. Programmes**

Sr. No.	Qualifying Degree	Minimum performance in the Qualifying degree for General/OBC (Non-Creamy Layer)/EWS category students	Qualification through national level examination requirements
1.	M. Tech./M.E./M.D. / or equivalent	60% marks or 6.00 CGPA on a 10-point scale	Nil
2.	M.Sc./MBA/M.A./ M.B.B.S. or equivalent	60% marks or 6.00 CGPA on a 10-point scale	Qualified GATE/ CSIR/UGC NET/ICAR/ICMR/DST-INSPIRE fellowship
3.	B.E. /B. Tech. or equivalent	70% marks or 7.00 CGPA on a 10-point scale	Qualified GATE/CSIR/UGC NET/ICAR/DST INSPIRE Fellowship

**Exemptions, relaxations and clarifications:**

- For **SC/ST/PwD category candidates**, the minimum performance in the qualifying degree (S. No. 1 & 2 in Table 1) is relaxed from 60% to 55% (CGPA relaxed from 6.00 to 5.50).
- For **SC/ST/PwD category candidates**, the minimum performance in the qualifying degree (Sr. No. 3 in Table 1) is relaxed from 70% to 65% (CGPA relaxed from 7.00 to 6.50).
- Qualifying degree performance is computed by **aggregating performance over all the semesters/years** of the qualifying degree, as per the credit or weightage system approved in the institution / board where the degree has been completed.
- Requirement of qualification in GATE / National Exam is waived for the following categories of applicants:
  - Currently registered students in Centrally Funded Technical Institutes (CFTIs) pursuing B. Tech./B.E./ Integrated M. Tech/ Integrated M. Sc. Programmes (or any other programme of minimum four year duration, admission to which is on the basis of JEE), who have completed 6 semesters or more, and have CGPA of 8.00 or above (on a 10 point scale). Such students must obtain a CGPA of 8.00 or above at the time of graduation, and before they formally register for the Ph.D. programme (80% aggregate marks, if marks are the primary mode of evaluation);
  - Graduates of CFTIs (in the programmes marked under (i)) with a final graduation CGPA of more than 8.00 (80% aggregate marks, if marks are the primary mode of evaluation);
  - M.A or M.Sc. graduates from IITs with CGPA 8.00 or above.
- For purposes of shortlisting, the **primary method of evaluation** (i.e., CGPA/CPI, or aggregate percentage, whichever is appropriate) followed by the institution where candidate has obtained his/her qualifying degree will be used by IIT Delhi for determining whether the candidate meets the final shortlisting requirements.
- For assistantship purposes only (and not for qualification), candidates with **M.B.B.S. qualification** will be considered equivalent to M. Tech., for admission to Ph.D. programme in Centre for Biomedical Engineering;

7. For candidates with M.A. degree in English, a 5% relaxation in marks or 0.5 relaxation in CGPA may be permitted for admission to the Ph.D. programme in Humanities and Social Sciences;
8. Candidates holding an MBA degree are eligible for applying to the Ph.D. programme in the Department of Management Studies.

**I(b) Minimum Qualifications for admission to Part-time and Sponsored (Full-time) Ph.D. Programmes:**

The following eligibility conditions apply for Part-time and Sponsored Full-time programmes:

1. Only employees of Public Sector Undertakings or Government Departments or Research and Development Organizations or Private Industries (approved by Faculty Boards) are eligible for admission to these programmes.
3. The minimum full-time experience required *after* obtaining the qualifying degree and as on date of registration, is given below in Table 2:

**Table 2: Experience required for admission to part-time Ph.D./ M.Tech./ M.S.(R) Programmes**

For admission to part-time programme	Qualifications	Work Experience (Post Qualification)
Ph.D.	M.E./M.Tech./M.S.(R)/M.D. or Equivalent	Nil
Ph.D.	B.E./B.Tech./M.Sc./M.A./M.B.A./MBBS or equivalent, from CFTIs/Central Universities	1 Year
Ph.D.	B.E./B.Tech./M.Sc./M.A./M.B.A./MBBS or equivalent, and working in IIT Delhi* (Project or Regular) *Through proper channel	1 Year
Ph.D.	B.E./B.Tech./M.Sc./M.A./MBA/MBBS or equivalent, from institutions other than CFTIs/Central Universities	2 Years
M. Tech./ MS(R)	B.E./B.Tech./M.Sc or equivalent, from CFTIs/Central Universities	6 Months
M. Tech./ MS(R)	B.E./B.Tech./M.Sc or equivalent, and working in IIT Delhi* (Project or Regular) * Through proper channel	6 Months
M. Tech./ MS (R)	B.E./B. Tech./M.Sc. or equivalent, from institutions other than CFTIs/ Central Universities)	1 Year

3. Minimum qualification for these candidates is the same as for full-time candidates (Table 1), except that the requirement of qualifying in a national examination (column 3 in Table 1) is waived.
4. For part-time candidates from outside NCR (or at a radial distance of more than 50 km from IIT Delhi), there is a minimum residency requirement of 6 months. DRC/ CRC/SRC may specify a higher residency requirement based on the courses recommended as well as the background.
5. **Sponsored (full-time) candidates** seeking admission to a Ph.D. programme on the basis of study leave, must submit a “Sponsorship Certificate” on a proper letterhead from the appropriate authority in the organization clearly stating the following:
  - for the period of his/her studies in the programme, the candidate would be treated as on duty with usual salary and allowances; and
  - that he/she will be fully relieved and granted study leave for a minimum period of 3

years (2 years for M. Tech. and equivalent degree holders).

6. **Part-time candidates** are required to submit a “No Objection Certificate” (NOC) on a proper letterhead from the appropriate authority in the organization clearly stating the following:
- the candidate is permitted to pursue studies on a part-time basis;
  - he/she will be fully relieved from duty and permitted to reside at the Institute for the period of required residency that is essential for completing the course work (this is not a requirement for candidates who are working in NCR or organizations located within a distance of 50 km from the Institute);
  - that his/her official duties permit him/her to attend required classes as per the Time Table of IIT Delhi;
  - that his/her official duties permit him/her to devote sufficient time for research;
  - facilities for research in the candidate’s field of research are available at the candidate’s place of work, in case the proposed Ph. D. research plan requires him/her to use these facilities when the candidate is physically present at this place of work.

Template of this NOC is available on the IIT Delhi PG admissions website. Kindly note that lack of confirmation and clarity on one or more of the above points in the NOC may prevent the applicant’s application being processed, even if he/she qualify in the interview/screening.

## **II. M. Tech./ M. S.(Research)/ M. Des. Programmes**

The Institute runs a number of M. Tech./ M. Tech. (High-Value Assistantship) and M. S. (Research) programmes offered by various Departments, Centres, and Schools. M. Tech. and M.S.(R) programmes mainly differ in the fraction of course and project/thesis credits. M. Tech. programmes may have up to two-thirds of the credits for the course work, while M.S.(R) programmes have two-thirds of the credits for the thesis component. Some of these programmes are interdisciplinary programmes (IDP) where multiple academic units are involved.. In these IDPs, students with different backgrounds are eligible to be admitted to the programme. IDPs are administered through a Programme Executive Committee or PEC. Master of Design (M. Des.) in Industrial Design is offered by the Department of Design. IIT Delhi also offers a number of industry-sponsored programmes. In these programmes, either industry supports full-time students recruited by the Institute, or sponsors their employees for the programme. In either case, regular industry feedback is obtained to adopt and improve the curriculum to the needs of the industry. Industry sponsors also play a significant role in defining the projects. The listing of all the Masters' programmes is given in **Annexure II**.

**Flexibility of movement:** *At IIT Delhi, easy mobility of students from M. Tech. to Ph.D., M. Tech. to M.S.(R), M.S.(R) to M. Tech. and M.S.(R) to Ph. D. is possible. It is possible for a student to join M. Tech./M.S. (R) at IIT Delhi, and subsequently they can apply for a change to a research programme if they feel confident. In this process, they save a considerable amount of time for completing Ph.D. degree. Further details are available in the Courses of Study booklet available on the IIT Delhi website.*

**Eligibility for programmes:** B. Tech. or M.Sc. degree holders of a particular discipline are eligible for admission to one or more programmes. The list of programmes to which a graduate of a specific discipline is eligible to apply, is given in **Annexure III**.

**Programme duration:** The minimum duration of M. Tech., M.S.(Research) and M. Des. programmes is 4 semesters (24 months) for full time and 6 semesters (36 months) for part-time programmes and M. Tech. (High Value Assistantship) programmes.

**Admission schedule:** Normally, M. Tech./ M. Tech. (High Value Assistantship)/ M.S.(R)/ M. Des. programmes are advertised in the month of March each year in Employment News as well as on electronic media and test/ interview are carried out in the month of May. M.S.(R) programmes are also advertised in the month of October followed by test/ interview in December.

Further, just like Ph.D. admission, admission to M.S.(R) programmes is also possible at **any time in the year** with the application being processed and candidates interviewed by the respective DRC/CRC/PEC. Students in this programme can be admitted to the Institute at any time of the year, though the course registration in such cases will be possible only at the beginning of the subsequent semester. Such candidates

must also fulfill the required academic qualifications /experience at the time of interview. They must join the Institute within 4 weeks after the issue of admission offer unless specifically permitted otherwise. Admission is subject to vacancy being available in the relevant specializations.

**Part-Time programmes:** IIT Delhi also offers most of its M.Tech. /M.S.(R) programmes in the part-time mode for working professionals. They are expected to complete their credit requirements in six semesters (maximum of ten semesters) by registering for a lower load than full-time students each semester. Departments /Centres/Schools offer most of the core courses between 8:00 AM to 10:00 AM to enable these working professionals to attend classes as well as continue with their full-time employment.

Please note it may not always be feasible to slot all courses of the programme in the above morning hours, and those candidates applying for part-time programmes should be flexible to take courses at other times, if required.

## **II (a) Minimum qualifications and procedure for admission to Full-time M. Tech./ M.S.(R)/ M. Des. Programmes:**

Table 3 lists the minimum qualifications required for admission to full-time M. Tech./ M.S.(R)/ M. Des. programmes at IIT Delhi. In this context, please note:

- ***These are Institute minimum requirements and any Department/Centre/School operating through their DRC/CRC/SRC/PEC can specify higher short-listing criteria than what is specified here.***
- This table includes many degrees for eligibility, but each DRC/CRC/SRC/PEC is free to specify the qualifying degree disciplines as well as GATE disciplines acceptable for admission to their programmes.
- Admission to M. Tech./M. S.(R)/M. Des. programmes have been normally carried out in the past by first short-listing the eligible candidates (meeting the minimum performance in their qualifying degree - Column 4 of Table 3), and scoring above a GATE / CEED cut-off specified for that programme and then conducting written test / interview at IIT Delhi. GATE / CEED cut-offs for various Programmes last year are tabulated in **Annexure IV**.

*As approved by the Senate of IIT Delhi, M.Tech./ M.Des. selections for Academic Year 2020-21 will be done completely on the basis of GATE/ CEED score, with shortlisting criteria set at Institute minimum (as given at Sr. No 2 and 4 in Table 3) for all categories with applicable exemptions. Interviews (via videoconferencing) will be conducted only for candidates who are valid applicants but do not have a GATE/CEED score (e.g. IIT graduates with CGPA more than or equal to 8.00, part-time, sponsored and international candidates). This procedure is adopted by Senate only for Academic Year 2020-21 in view of the COVID-19 outbreak, and the logistic and travel-related challenges that have been created by the current situation. MS(R) admissions may be done based on GATE score only (along similar lines of M. Tech. selections).*

- Candidates in the final year of their programmes and who expect to complete all their qualifying degree requirements before the third week of July 2020, are eligible to apply for admission. For short-listing purposes, their performance till the preceding semester (preceding year if their programmes are year based) would be considered, but their admission would be provisional, subject to their meeting the minimum eligibility criteria after their final qualifying examination results are announced.

**Table 3: Minimum Qualification for Admission to full-time M.Tech./M.S.(R)/ M.Des. Programs**

S. No.	Programme & Admission type	Qualifying Degree	Minimum performance in the qualifying degree for General/ OBC (Non-Creamy Layer)	National level examination Requirements
1.	M. Tech./ M. Tech.(High Value Assistantship)/ M.S.(R) (Direct Admission with GATE Score)	B.E./B. Tech./ M.Sc. or equivalent	60% marks or 6.00 CGPA on a 10- point scale	Qualifying GATE score
2.	M. Des. (Direct Admission with CEED Score)	B.E./B. Tech./B. Arch. or	60% marks or 6.00 CGPA on a 10- point scale	Valid CEED Score

**Exemptions, relaxations and clarifications:**

1. For *SC/ST/PwD category students*, minimum performance in the qualifying degree is relaxed from 60% to 55% (CGPA 6.00 to 5.50).
2. Qualifying degree performance is computed by *aggregating performance over all the semesters/years* of the qualifying degree.
3. The offer of admission to M.Tech. Programme will have to be accepted on the Common Offer Acceptance Portal (COAP). Detailed instructions in this regard will be provided on the IIT Delhi website.
4. Candidates with AMIE or Grad. IETE qualifications may also be considered for admission to the M. Tech. Programmes; however, if provisionally selected for admission based on their AMIE/Grad IETE performance, they would be required to complete 24 valid undergraduate credits prescribed by the concerned DRC/CRC/ SRC/PEC and clear the GATE examination before being actually admitted to the M. Tech./ M.S.(R)/M. Des. Programmes.
5. For admission to all the above programmes, candidates with *B.Tech. from IITs*, graduating with a CGPA of 8.00 or above, are exempted from qualifying GATE/ CEED. If shortlisted, they will be interviewed through videoconferencing.
6. For admission to M.S.(R), requirement of qualification in GATE / National Exam is waived for the following categories of applicants:
  - (i) Currently registered students in Centrally Funded Technical Institutes (CFTIs) having CGPA of 8.00 or above (on a 10 point scale) at the end of 6th semester or later, in B. Tech./B.E./ Integrated M. Tech/ Integrated M. Sc. Programmes (or any other programme of minimum four year duration, admission to which is on the basis of JEE), the requirement of GATE / National Exam

is waived for consideration of admission to the M.S. (R) programme in IIT Delhi. Moreover, such students must have obtain a CGPA of 8.00 or above at the time of graduation (and before they formally register for the M.S.(R) programme).

- (ii) Graduates of CFTIs (in the programmes marked under (i)) with a final graduation CGPA of more than 8.00 (80% aggregate marks, if marks is the primary mode of evaluation);
- (ii) M.A or M.Sc. graduates from IITs with CGPA 8.00 or above.

However, if a candidate admitted to M.S.(R) programme following the above criterion wanted to convert to M.Tech. programme, he/she should also meet the shortlisting criteria of the M.Tech. programme, in addition to the conversion criteria (including requirement, if any, of a valid examination in GATE / National Examination).

7. *As approved by the Senate, M. Tech./ M. Des. selections for Academic Year 2020-21 will done completely on basis of GATE/ CEED score, with shortlisting criteria set at Institute minimum (as given at Sr. No 2 and 4 in Table 3) for all categories with applicable exemptions. Interviews (via videoconferencing) will be conducted only for candidates who are valid applicants but do not have a GATE/CEED score (IIT graduates with CGPA more than or equal to 8.00, part-time, sponsored and international candidates). This procedure is adopted by Senate only for Academic Year 2020-21 in view of the COVID-19 outbreak, and the logistic and travel-related challenges created by the current situation.*
8. *MS(R) admissions will be made through interviews through videoconferencing. However, these may also be done based on GATE score only (along similar lines of M. Tech. selections), if any Academic Unit decides to do so.*

## **II(b) Minimum Qualifications for admission to Part-time and Sponsored (Full-time) M.Tech. / M.S.(R) Programmes:**

The following additional eligibility conditions and relaxations apply for the Part-time and sponsored full-time programmes.

1. Only employees of Public Sector Undertakings or Government Departments or Research and Development Organizations or Private Industries (approved by Faculty Boards) are eligible for admission to these programmes.
2. Employees of only those organizations which are located within 50 km radius of IIT Delhi are eligible to be considered for admission to part-time M.Tech./ M.S.(R) programmes.
3. The minimum experience (Full Time) required after qualifying degree and as on date of registration is as given in Table 2 above.
4. Minimum qualification for these candidates is the same as for full-time candidates except that the requirement of qualifying in a national examination (Column 4 in Table 3) is waived off. All Part-time and Full-time Sponsored candidates will be interviewed through Videoconferencing, if shortlisted.
5. **Sponsored (full-time) candidates** seeking admission to a M.Tech./M.S.(R) programme on the basis of study leave, must submit a “Sponsorship certificate” on a proper letterhead from the appropriate authority in the organization clearly stating the following:
  - a. for the period of his/her studies in the programme, the candidate would be treated as on duty with usual salary and allowances, and
  - b. that he/she will be fully relieved and granted study leave for a minimum period of 2 years
6. **Part-time candidates** are required to submit a “No Objection Certificate” on a proper letterhead from the appropriate authority in the organization clearly stating the following:
  - the candidate is permitted to pursue studies on a part-time basis
  - that his/her official duties permit him/her to devote sufficient time for studies
  - that he/she will not be transferred to any other place during the period of study.
7. Please note that all part-time and sponsored candidates will have to go through an interview or selection process.

### III. M. Sc. Programmes (M.Sc. in Economics and M.Sc. in Cognitive Science)

The Institute is introducing two new programmes, M.Sc. in Economics and M.Sc. in Cognitive Science (two-year Full time), at the Department of Humanities and Social Sciences from July 2020.

**Eligibility for programmes:** Any Bachelor's Degree or equivalent awarded by any of the universities incorporated by an act of the central or state legislature in India or other educational institutions established by an act of Parliament or declared to be deemed as a University under Section 3 of the UGC Act, 1956, or an equivalent qualification recognized by the Ministry of HRD, Government of India, including Bachelor Degrees from universities/institutes located outside India, subject to the guidelines for admission of foreign students as laid forth by the statute of IIT Delhi. The bachelor's degree or equivalent qualification obtained by the candidate must entail a minimum of three years of education after completing higher secondary schooling (10+2) or equivalent.

**Programme duration:** The duration of M. Sc. programmes is 4 semesters (24 months).

#### **Admission schedule:**

**Cognitive Science:** The advertisement of M.Sc. in Cognitive Science programme comes in the month of November through the COGJET entrance exam portal ([https://oag.iitk.ac.in/cogjet/Jsp/cogonline/jmet\\_login.jsp](https://oag.iitk.ac.in/cogjet/Jsp/cogonline/jmet_login.jsp)). In addition, IIT Delhi advertises this programme for call of applications in the month of March in employment news and electronic media. The admissions are carried out in the month of July.

**Economics:** The M.Sc. in Economics programme will be advertised in the month of March in Employment News as well as on electronic media. **The written admission test will be conducted on a date to be decided later in view of COVID-19 outbreak. Candidates should keep checking the IIT Delhi website and webpage <https://joaps.iitd.ac.in/hes2020/> for updates.** The admissions are carried out in the month of August.

#### **Minimum qualifications and procedure for admission to M. Sc. in Economics and M.Sc. in Cognitive Science Programmes:**

Table 4 lists the minimum qualifications required for admission to full-time M.Sc. in Economics and M.Sc. in Cognitive Science programmes at IIT Delhi. In this context, please note:

- These are Institute minimum requirements and the Department can specify higher short-listing criteria than what is specified here.
  - The admission to M.Sc. in Cognitive Science will be through a central national-level Joint Admission Test in Cognitive Science (COGJET). The Joint Admission Test in Cognitive Science which is currently being organized in India by IIT Kanpur and Centre for Behavioural and Cognitive Sciences (CBCS), University of Allahabad across multiple centers in India for admission to the Master and Doctoral programmes in cognitive science. The candidates with a valid COGJET score (above a certain cut-off) will be invited to appear before an interview panel.
  - The admission to M.Sc. in Economics will be through a national level entrance test to be conducted by the Institute. Candidates can apply for the programme only through JAM Online Application Processing System (JOAPS) link available at the website: <https://joaps.iitd.ac.in/hes2020/>. The facility for Online Registration and Application will be available from March 02, 2020 to **May 10, 2020**. The written entrance test will be held **on a date\* to be decided later in view of COVID-19 outbreak**. All shortlisted candidates based on the written entrance test will appear before an interview panel. The syllabus and the pattern of the written test is given in Annexure V. For application fee and other details, please refer to the website <https://joaps.iitd.ac.in/hes2020/>.
- \* Please visit the portal <https://joaps.iitd.ac.in/hes2020/> for regular updates*
- Candidates in the final year of their programmes and who expect to complete all their qualifying degree requirements before the third week of July 2020, are eligible to apply for admission. For short-listing purposes, their performance till the preceding semester (preceding year if their programmes are year based) would be considered, but their admission would be provisional, subject to their meeting the minimum eligibility criteria after their final qualifying examination results are announced.

**Table 4: Minimum Qualification for Admission to M.Sc. Programmes**

<b>Programme &amp; Admission type</b>	<b>Qualifying Degree</b>	<b>Minimum performance in the qualifying degree for General/ OBC (Non-Creamy Layer) category students</b>	<b>National level examination Requirements</b>
M.Sc. Economics (Admission with written test and interview)	Bachelor's degree (B.A./B.Sc./B.Com /B.Stat./B.Math./ B.Tech/B.E. or equivalent)	At least 55% or 5.5 CGPA on a 10-point scale.	Admission test conducted by IIT Delhi.
M.Sc. Cognitive Science (Admission with valid COGJET score and personal interview)	Bachelor's degree (B.A./B.Sc./ B.Tech. / B.E. or equivalent)	At least 55% or 5.5 CGPA on a 10-point scale.	Valid COGJET score

**Exemptions, relaxations and clarifications:**

1. For *SC/ST/PH category students* minimum performance in the qualifying degree is relaxed from 55% to 50% (CGPA 5.5 to 5.00).
2. Qualifying degree performance is computed by *aggregating performance over all the semesters/years* of the qualifying degree. Taking into account all subjects including languages and subsidiaries, all years combined.
3. Applicants with valid JAM/GATE/CSIR/JRF/NET scores (where applicable) would be waived from COGJET. In addition, applicants from CFTIs with a minimum GPA of 8.0, **B.Tech. from IITs** graduating with a CGPA of 8.0 or above, and those with an MBBS degree from recognized institutions and universities are exempted from the COGJET/GATE/JAM/CSIR/JRF/NET requirement. This will be subject to revision as decided by the academic section of IIT Delhi and will be as per rules.
4. For M.Sc. in Economics, all eligible applicants must appear in the written admission test and interview.
5. Admission to the other three existing M.Sc. programmes (Physics, Chemistry, Maths) is through Joint Admission Test for M.Sc. (JAM).

**RESERVATION OF SEATS**

- (a) 15% seats are reserved for SC and 7.5% for ST candidates.
- (b) 27% seats are reserved for Non-Creamy layer OBC candidates. All candidates applying for admission under this category should produce the OBC (Non-Creamy Layer) Certificate applicable for OBCs in the Central list at the time of interview. For details and specimen form visit: <http://www.iitd.ac.in>.
- (c) 5% seats in the respective categories are reserved for the Persons with Disability (PwD) in the Postgraduate courses and Ph.D. Programmes.
- (d) 10% seats are reserved for EWS (Economically Weaker Section) candidates.

**Note:** All shortlisted candidates applying for admission under the reserved categories are required to produce the relevant certificate at the time of interview. The Scheduled Tribe (ST) category candidates are required to produce 'Validity Certificate' along with the ST category certificate.

## REGISTRATION FOR COURSES

All students are required to report for Orientation and Central Registration before the commencement of each semester according to the schedule/procedure notified in advance. The students register themselves for the courses in consultation with the Course Coordinator. The courses to be run by the Departments are made known to the students before registration. On admission, the students should go through carefully the Departmental advice of courses for their discipline. They should also go through the **Prospectus** as well as the **Courses of Study** regarding the rules governing their academic duties and performance. In some Departments, the required performance levels for the continuation of registration may be higher than those given in the Prospectus and the Courses of Study. The admitted students must acquire a copy of the departmental norms in such cases.

## HOSTEL ACCOMMODATION

All post-graduate students admitted on a full-time basis may, subject to availability and hostel accommodation policy, avail of residential facilities in the hostels. The Institute has eleven boys' hostels and two girls' hostels.

**It may be noted that at present, there is a severe shortage of hostel accommodation owing to renovation activities and an increase in student strength, and the Institute may not be in a position to offer hostel accommodation to all post-graduate students.**

## FEES AND PAYMENTS

### (a) INSTITUTE DUES PAYABLE BY 2020 ENTRY PH.D./M.TECH./M.S.(R)/M.DES./M.Sc. STUDENTS

**Table 5: Schedule of fee applicable for different programmes**

Category	Tuition Fees	Other Charges	Hostel Seat Rent & Amenity Charges <sup>#</sup>	Total Amount
<b>M.Tech./M.S.(R)/M.Des. Students Receiving Institute/Project Assistantship or Teaching positions holders</b>				
General/OBC/EWS	10000	16450	10500	36950
SC/ST/PwD	0	16450	10500	26950
<b>M.Tech/ M.S.(R)/M.Des. Students(Sponsored Full Time, Part Time and Non-Teaching position holders)</b>				
General/OBC/EWS	50000	14950	0	64950
SC/ST/PwD	0	14950	0	14950
<b>All Full Time Ph.D. Students</b>				
General/OBC/EWS	5000	16450	10500	31950
SC/ST/PwD	0	16450	10500	26950
<b>All Part Time Ph.D. Students</b>				
General/OBC/EWS	10000	14950	0	24950
SC/ST/PwD	0	14950	0	14950
<b>M.Sc.</b>				
General/OBC/EWS	5000	16450	8000	29450
SC/ST/PwD	0	16450	8000	24450

**Note:** - SC/ST/PwD students are given 100% exemption from payment of tuition fee.

- <sup>#</sup>Non-Hostelers/ Part Time Sponsored students need not pay the Hostel Seat Rent of Rs. 10500/- (for M.Tech./M.S.(R)/M.Des./Ph.D.) and Rs. 8000/- (for M.Sc.). Please note that admission and hostel allocation are delinked and Hostel Seat Rent is only to be paid if hostel is allotted.

## MESS DUES PAYABLE BY 2020 ENTRY STUDENTS

Membership of associated mess is compulsory *only for those allotted Hostel accommodation*. They will be required to pay Mess Dues at the time of joining as detailed in Table 6.

**Table 6: Hostel Mess Fees applicable at the time of joining the Mess**

Details	Amount
Mess Security Deposit (Refundable)	Rs. 15,000
Mess Admission (onetime payment) (Nonrefundable)	Rs. 10,000
Mess Advance (onetime payment adjustable against mess)	Rs. 25,000
<b>Total</b>	<b>Rs. 50,000</b>

## FINANCIAL ASSISTANCE AND OTHER SUPPORT

### I. Ph.D. Programme

A scheme for the award of Teaching/Research Assistantship for providing financial assistance to the students exists. In terms of this scheme, those non-sponsored students who are admitted on full-time basis are considered for the award of Teaching/Research Assistantship. These rates have been significantly enhanced by the MHRD recently and are as indicated below:

**Table 7: Assistantship amounts for Full-time Institute Ph.D. students**

Period of assistantship	Assistantship amount	Hours/week assistance to be provided
	With B.Tech/B.E./M.Sc./ M.Tech./M.E./MBBS or equivalent qualifications	
First 2 years of Registration	Rs. 31,000/- p.m.	8
Next 3 years of Registration	Rs.35,000/- p.m.	8

*Under the Prime Minister's Research Fellowship (PMRF) Scheme, certain number of fellowships are allocated to the Institute. While PMRF fellows are governed by the same academic rules as any other research scholar, the selection of PMRF fellows is through a separate process approved by the National Coordination Committee (NCC) of PMRF. This may undergo some changes in 2020; current status may be viewed at: : <https://pmrf.in>.*

**Other conditions and benefits:** In addition, the full-time students enjoy a number of benefits but are also required to satisfy academic performance requirements for continuation of assistantship from semester to semester.

- The maximum duration for which assistantship can be awarded to a Ph.D. student is 5 years.
- In the first instance, the assistantship is awarded for one semester. Continuation of the assistantship during the subsequent semesters is contingent upon satisfactory academic performance and satisfactory performance in the discharge of responsibilities assigned under the assistantship scheme. For this purpose, an SGPA of 7.00 at the end of a semester in respect of those semesters when the student has been assigned coursework will be considered as satisfactory performance. For details of SGPA calculation refer to the Institute Prospectus.
- All full-time students participating in a sponsored project/consultancy project (in addition to their assistantship work) can be paid an honorarium of up to Rs. 25,000/- p.m. by the PI/CI of the project. All such work can be undertaken only with the consent of their supervisor(s).

- The faculty of an Engineering/Science College sponsored by his/her institution for pursuing Ph.D. at IIT Delhi and meeting all the academic requirements of full-time Institute assistantship can be considered by the DRC/CRC/SRC/PEC for the award of Institute Assistantship. This assistantship would be over, and above the emoluments, he/she may be getting from his/her parent institution.
- A part from Institute assistantship, IIT Delhi has a number of assistantships sponsored by national as well as international institutions and/or industries. All students including faculty of engineering/science colleges meeting the academic qualifications for admission as full-time students with Institute assistantship are also entitled to apply for these. For more information on the availability of such scholarships in your area, please contact your respective department/centre/school.
- In exceptional cases with the approval of the Chairman, Senate, Sponsored (Fulltime) candidates employed in CSIR/DRDO/PSUs may also be offered assistantship provided they have qualified either GATE or any other national level examination like CSIR/UGC NET/ICAR etc. and fulfill the requirement for award of assistantship and their employer has no objection to the same.
- Institute provides seed money of Rs. 20,000/- once during the program as partial financial assistance for presenting papers abroad in good academic conferences. All full time (and part-time on IRD/ FITT Projects) Research Scholars are also eligible for additional financial assistance of Rs. 1,30,000/- as Research Scholar Travel Award (RSTA). Some highly meritorious Research Scholars are also eligible for an additional travel grant of Rs. 1,50,000/- as Research Excellence Travel Award (RETA).
- Institute is in the process of formalizing a number of agreements with leading foreign institutions or agencies for supporting up to 6 months long research visits by Ph.D. students. This would enable interested students with the consent of their supervisor and DRC/CRC/SRC to undertake a research visit which would increase his/her exposure while adding value to his/her work.
- It is expected that all assistantship holders will have the good general physique. He/She will have to produce on the date of Central Registration, a certificate to that effect in the prescribed format. A copy of the format would be given along with the admission offer letter. The admission is subject to his/her being found medically fit.

## **II M. TECH./ M.S. (R) / M.DES. STUDENTS AND M.TECH. (HIGH-VALUE ASSISTANTSHIP)**

A scheme for the award of Teaching/Research Assistantship for providing financial assistance to the students exists. The present scheme is described below:

- Students admitted to M.Tech./ M.S.(R) and M.Des. Programmes on full-time basis are considered for the award of Teaching Assistantship under which they will be paid Rs.12,400/- per month and would be required to provide assistance of 8 hours/week to the Department/Centre/School.
- Only full-time non-sponsored students who have qualified GATE/CEED are eligible for assistantship
- The maximum duration for which Assistantship can be awarded to M.Tech./ M.S.(R)/ M.Des. students is 4 semesters.
- Students admitted to M Tech. (High Value Assistantship) Programmes basis are considered for the award of High Value Assistantship under which they will be paid Rs. 22,000/- per month (likely to be revised) and would be required to provide assistance of 20 hours/week to the Department/Centre/School.
- The maximum duration for which Assistantship can be awarded to M. Tech. (High Value Assistantship) students is 6 semesters.
- In the first instance, the assistantship is awarded only for one semester. Thereafter, continuation of the assistantship during each semester is contingent upon satisfactory academic performance and satisfactory performance in the discharge of responsibilities assigned under the assistantship scheme. For this purpose an SGPA of not less than 7.00 (6.75 in the case of SC/ST/PwD) at the end of the semester is treated as satisfactory academic performance.

- All full-time M.Tech./M.S.(R)/M.Des. students participating in a sponsored project/ consultancy project (in addition to their assistantship work) can be paid an honorarium of upto Rs. 3,000/- p.m. by the PI/CI of the project. All such work can be undertaken only with the consent of their supervisor(s).
- Candidates qualified for CSIR JRF will not be allowed to avail fellowship for doing M.Tech./M.S.(R) programmes. However, they can avail the CSIR fellowship for doing the Ph.D. programme.
- Apart from the above-mentioned scheme for teaching/research assistantships, there are a number of fellowships/scholarships instituted by Industries/Individuals. (For more information on these scholarships/ assistantships/fellowships please contact the respective department).
- A number of DAAD scholarships under the Sandwich System may be available. Indian Students pursuing M.Tech./M.S. (R) at IIT Delhi are eligible for this scholarship for doing their thesis work for about 6 months at one of the nine German Technical Universities (TU9).
- Institute is pursuing a number of other collaborative agreements with leading research laboratories and universities to enable such research visits by post-graduate students
- It is expected that all assistantship holders will have good general physique. He/she will have to produce on the date of Central Registration, a certificate to that effect in the prescribed format. A copy of the format would be given along with the admission offer letter. The admission is subject to his/her being found medically fit.

### III. M.Sc. Programme

- **Merit-cum-Means (MCM) Scholarship** – Merit-cum-Means scholarship of Rs. 1,000/- per month and tuition fee waiver are permissible to M.Sc. students to the extent of 25% of the sanctioned strength as per Institute rules. Only those students are eligible whose parents' gross income is upto Rs. 4.5 lac per annum for all categories of students / as per govt. orders as applicable.
- **Freeship** – Tuition Fee Waiver to the students whose annual family income is upto 4.5 lac (awarded up to 10% of the students admitted).
- **Free Messing** - SC/ST students with Parental Income upto 4.5 lac are provided Free-Messing.

### GENERAL GUIDELINES

- The minimum eligibility criteria indicated above for each programme is only an enabling clause. The Deptt./Centre/School may fix higher criteria at the time of short listing keeping in view the number of candidates, minimum background expected to cope with the programme etc.**
- The minimum prescribed marks in aggregate (of all the years/semesters of the qualifying examination) is calculated by IIT Delhi as per example given below:

Years	1st Semester (%)		IInd Semester (%)	
1st year	250/400	62.50	290/400	72.50
IInd Year	205/400	51.25	280/400	70.00
IIIrd Year	210/400	52.50	350/400	87.50
IVth Year	240/400	60.00	150/200	75.00
	<b>Total</b>	<b>905/1600</b>		<b>1070/1400</b>

Aggregate (% age)  $1975/3000=65.83\%$  (of all the years/semesters)

- Admission on part-time basis is further subject to the availability of seats for part-time and decision of the respective DRC/CRC/PEC.
- Candidates who are in the final year of their qualifying examination can be considered for admission only if they complete the requirement of their final examination including Viva-Voce by the date of Registration given on page 5. Candidates must inform Academics (P.G.) Section, IIT

Delhi in writing by the date of Registration, if the requirements of their qualifying degree including Viva-Voce, if any, are not met by this date. Failure to inform the Academics (P.G.) Section about non-completion shall result in forfeiture of entire fees deposited by them in addition to cancellation of their admissions.

- (e) The applications will be scrutinized by the Department/Centre/School concerned. **As approved by the Senate, M. Tech./ M.Des. selections for Academic Year 2020-21 will done completely on basis of GATE/ CEED score, with shortlisting criteria set at Institute minimum for all categories. Interviews (via videoconferencing) will be conducted only for candidates who are valid applicants but do not have a GATE/CEED score (IIT graduates with CGPA more than or equal to 8.00, part-time, sponsored and international candidates). Conduct of interviews for admission to Ph.D. programme will also be done online through videoconferencing. This procedure is adopted by Senate only for Academic Year 2020-21 in view of the COVID-19 outbreak, and the logistic challenges in inviting students on campus for interviews, or doing interviews via videoconferencing for a large number of candidates.**
- (f) Application incomplete, in any respect, is liable to be rejected.
- (g) A provisional list of applicants selected for admission and of applicants selected for the award of Assistantship along with those placed on waiting will be displayed on the Department/Centre/School notice board /website within a day of the test/interview. The selected candidates would be required to pay the first installment of fees soon after the admission offer letter is issued to the candidates failing which seats will be offered to those on the waitinglist.
- (h) (j)

### **APPLICATION PROCEDURE**

Submission of Application is only through online procedure. Candidates are **NOT** required to send hard copy of the application form and bank challan. Online submission of the application form for all programmes except M.Sc. in Economics may be made by accessing the Institute website **<https://ecampus.iitd.ac.in/PGADM>**. Candidates belonging to General/OBC category are required to pay for each application form a fee of Rs. 200/- and the candidates belonging to SC/ST/PwD categories are required to pay Rs. 50/-. The bank charges will be borne by the candidate.

**For M.Sc. in Economics**, candidates must apply only through JAM Online Application Processing System (JOAPS) link available at the website <https://joaps.iitd.ac.in/hes2020/>. The applications fee for M.Sc. in Economics is Rs. 750/- for female (all categories)/SC/ST/PwD candidates and Rs. 1500/- for all others. The bank charges will be borne by the candidate.

### **REFUND OF FEES**

The whole amount of fees/other charges deposited by the candidates will be refundable after deduction of Rs.1,000/- if the candidates do not join the programme after paying the dues and leave the Institute by applying for refund on or before the date of registration. On resignation after registration, only security deposit will be refunded.

For refund of fees and/or security deposit the student must apply on the prescribed form available from the P.G. Section, IIT Delhi or the Institute Website: [http:// www.iitd.ac.in](http://www.iitd.ac.in).

## **IMPORTANT INSTRUCTIONS FOR FILLING APPLICATION FORM**

- a) Separate application form should be filled for Ph.D. programme for each Department/Centre/School. Separate application form should be filled for each M.S.(R) programme.
- b) Separate application form should be filled for M.Des. programme.
- c) Separate application form should be filled for each interdisciplinary M.Tech. programme.
- d) Separate application form should be filled for each M.Sc. programme. For M.Sc. Economics, the application portal is <https://joaps.iitd.ac.in/hes2020/> .
- e) The applicant seeking admission to M.Tech. programme of a particular department should fill a separate application form. He/she may give upto **four choices** in order of preference for the M.Tech. Programmes available in that department. However, he/she will be considered only for two choices for which he/she is eligible in the order of preference given. In case a candidate is found to have filled more than one form of a particular department, his/her candidature will be cancelled.
- f) For the GATE qualified candidates applying for full-time M.Tech. Programme, the offer for admission, if selected, will be through Common Offer Acceptance Portal (COAP). Such candidates must register on COAP portal before applying and mention COAP Registration No. in the application form.
- g) GATE score cut off criteria used for short-listing candidates in different non-sponsored (full-time) M.Tech. programmes during the previous academic year is given in **Annexure IV**. This is only for the candidate's reference and the criteria may even change substantially based on applications received for the current admissions.
- h) Part-time/Sponsored (full-time) candidates must submit NOC/Sponsorship Certificate from their employer at the time of interview.
- i) Filling of false information will lead to rejection of application/cancellation of admission.

Fill the programme code at the appropriate place in the Application Form. The Ph.D. programme codes are given in **Annexure-I** and M.Tech./M.S. (R)/M.Des./M.Sc. programme codes are given in **Annexure-II**.

## CONTACT TELEPHONE NOS AND EMAIL-IDS

1. For any query/clarification, please contact **P.G. Section** at the following telephone Nos.: Tel: 011-26591780, 011-26591743 or write to [drpgsr@admin.iitd.ac.in](mailto:drpgsr@admin.iitd.ac.in) (preferred) .
2. For query regarding the date of interview, selection result and operation of waiting list, please contact the concerned Deptt./Centre/School at the following Emails IDs (preferred) or Telephone Numbers (prefix area code 011 if calling from within India, and country code/area code 0091/11 if calling from outside India):

<b>DEPARTMENTS</b>	<b>TELEPHONE</b>	<b>EMAIL-ID</b>
Applied Mechanics	26591201	<a href="mailto:hodam@admin.iitd.ac.in">hodam@admin.iitd.ac.in</a>
Biochemical Engineering and Biotechnology	26591001	<a href="mailto:hoddbeb@admin.iitd.ac.in">hoddbeb@admin.iitd.ac.in</a>
Chemical Engineering	26591021	<a href="mailto:hodchemical@admin.iitd.ac.in">hodchemical@admin.iitd.ac.in</a>
Chemistry	26591501	<a href="mailto:hodchemistry@admin.iitd.ac.in">hodchemistry@admin.iitd.ac.in</a>
Civil Engineering	26591241	<a href="mailto:hodcivil@admin.iitd.ac.in">hodcivil@admin.iitd.ac.in</a>
Computer Science and Engineering	26591291	<a href="mailto:hodcse@admin.iitd.ac.in">hodcse@admin.iitd.ac.in</a>
Design	26591431	<a href="mailto:hoddod@admin.iitd.ac.in">hoddod@admin.iitd.ac.in</a>
Electrical Engineering	26591071	<a href="mailto:hodee@admin.iitd.ac.in">hodee@admin.iitd.ac.in</a>
Humanities and Social Sciences	26591371	<a href="mailto:hodhss@admin.iitd.ac.in">hodhss@admin.iitd.ac.in</a>
Management Studies	26591171	<a href="mailto:hoddms@admin.iitd.ac.in">hoddms@admin.iitd.ac.in</a>
Mathematics	26591471	<a href="mailto:hodmaths@admin.iitd.ac.in">hodmaths@admin.iitd.ac.in</a>
Materials Science and Engineering	26596659	<a href="mailto:hodmse@admin.iitd.ac.in">hodmse@admin.iitd.ac.in</a>
Mechanical Engineering	26591051	<a href="mailto:hodmech@admin.iitd.ac.in">hodmech@admin.iitd.ac.in</a>
Physics	26591331	<a href="mailto:hodphysics@admin.iitd.ac.in">hodphysics@admin.iitd.ac.in</a>
Textile and Fibre Engineering	26591401	<a href="mailto:hodtextile@admin.iitd.ac.in">hodtextile@admin.iitd.ac.in</a>
<b>CENTRES</b>		
Applied Research in Electronics	26591101	<a href="mailto:hodcare@admin.iitd.ac.in">hodcare@admin.iitd.ac.in</a>
Atmospheric Sciences	26591301	<a href="mailto:hodcas@admin.iitd.ac.in">hodcas@admin.iitd.ac.in</a>
Automotive Research and Tribology	26591281	<a href="mailto:hodcart@admin.iitd.ac.in">hodcart@admin.iitd.ac.in</a>
Biomedical Engineering	26596132	<a href="mailto:hodcbme@admin.iitd.ac.in">hodcbme@admin.iitd.ac.in</a>
Energy Studies	26591251	<a href="mailto:hodces@admin.iitd.ac.in">hodces@admin.iitd.ac.in</a>
Rural Development and Technology	26591121	<a href="mailto:hodrdat@admin.iitd.ac.in">hodrdat@admin.iitd.ac.in</a>
Sensors, Instrumentation and Cyber-physical Systems Engineering	26591431	<a href="mailto:hodsense@admin.iitd.ac.in">hodsense@admin.iitd.ac.in</a>
National Resource Centre for Value Education in Engineering	26596585	<a href="mailto:hodnrcvee@admin.iitd.ac.in">hodnrcvee@admin.iitd.ac.in</a>
<b>SCHOOLS</b>		
Amar Nath and Shashi Khosla School of Information Technology	26596056	<a href="mailto:sitcoord@admin.iitd.ac.in">sitcoord@admin.iitd.ac.in</a>
Bharti School of Telecommunication Technology and Management	26596200	<a href="mailto:bharti.coord@admin.iitd.ac.in">bharti.coord@admin.iitd.ac.in</a>
Kusuma School of Biological Sciences	26596104	<a href="mailto:biocoordinator@admin.iitd.ac.in">biocoordinator@admin.iitd.ac.in</a>
School of Interdisciplinary Research	26591507	<a href="mailto:hodsire@admin.iitd.ac.in">hodsire@admin.iitd.ac.in</a>
School of Public Policy	26596508	<a href="mailto:hodspp@admin.iitd.ac.in">hodspp@admin.iitd.ac.in</a>
<b>INTERDISCIPLINARY R&amp;D PROGRAMMES</b>		
Transportation Research and Injury Prevention Programme	26596361	<a href="mailto:coordetri@admin.iitd.ac.in">coordetri@admin.iitd.ac.in</a>
<b>INTERDISCIPLINARY M.TECH. PROGRAMMES</b>		
Industrial Tribology and Maintenance Engineering	26591280	<a href="mailto:fatima@itmmec.iitd.ac.in">fatima@itmmec.iitd.ac.in</a>
Instrument Technology	26591437	<a href="mailto:gufranskhan@sense.iitd.ac.in">gufranskhan@sense.iitd.ac.in</a>
VLSI Design, Tools and Technology	26591085	<a href="mailto:shouri@ee.iitd.ac.in">shouri@ee.iitd.ac.in</a>
Telecommunication Technology and Management	26596200	<a href="mailto:bharti.coord@admin.iitd.ac.in">bharti.coord@admin.iitd.ac.in</a>
Opto-Electronics and Optical Communication	26591331	<a href="mailto:prakash@physics.iitd.ac.in">prakash@physics.iitd.ac.in</a> <a href="mailto:vivekv@ee.iitd.ac.in">vivekv@ee.iitd.ac.in</a>
Energy Studies	26591251	<a href="mailto:rams@ces.iitd.ac.in">rams@ces.iitd.ac.in</a>

### **RESEARCH PROGRAMMES : DOCTOR OF PHILOSOPHY (Ph.D.)**

The Institute offers research programmes leading to the degree of Ph.D. in the following areas in the various Departments/Centres/Schools.

#### **Department of Applied Mechanics [Code AMZ]**

**Research Areas in Solid Mechanics:** Large Deformations, Impact Mechanics, Elasticity, Piezothermoelasticity, Composite Materials and structures Plates and Shells, Non-linear Dynamics and Chaos, Off-Shore Structures, Smart Structures, Structural Stability, Snow Mechanics, Dynamic Plasticity, Nano Composites, Damage Mechanics, Soft Materials, Structural Health Monitoring, Functionally Graded Structures, Multi-Scale Modelling of Nano-Structures, Biomechanics/Cell Mechanics, Cardiovascular Biomechanics, Brain Biomechanics, Computational Surgery.

**Research Areas in Fluid Mechanics:** Internal and External Flows, Solid-Liquid Flows, Computational Fluid Dynamics, Hydrodynamic Stability; Turbulence, Aerodynamics; Turbulent Heat Transfer Compressible Flows, Fluid-structure Interaction

**Research Areas in Design Engineering:** Computer Aided Design, Design Engineering., Reliability Engineering, Engineering Alternative, Ergonomics, Reverse Engineering, Design and Analysis of Biomedical Devices, Compliant Mechanisms and Smart Instrumentation, Bio-inspired Engineering.

#### **Department of Biochemical Engg. and Biotechnology [Code BEZ]**

**Microbial and Enzyme Engineering:** Analysis and design of microbial and enzyme reactors for production of industrially important products such as biofuels, industrial enzymes, biopolymers, organic solvents, biofertilizers and biopesticides etc.; development of bio-sensors for detection of various analytes; Whole cell catalyzed biotransformations.

**Bioseparation and Downstream Processing:** Membrane based separation processes, chromatographic separation processes, Membrane processes for water recycle.

**Metabolic engineering:** Application of metabolic engineering principles for the development of cell factories for the production of important metabolites including renewable chemicals and therapeutic compounds.

**Animal and plant cell culture:** Development of cell culture techniques for cultivation of plant and animal cells in specialized reactors for production of therapeutic compounds.

**Environmental Biotechnology:** The development of reactors and processes for stabilization of organic and industrial wastes; Laccase engineering for treatment of textile effluents; Effect of environmental factors on microbial community dynamics.

**Biochemistry and molecular biology:** Industrial enzymes, development of recombinant clones for over-production of enzymes and metabolites, development of expression systems in bacteria and yeasts, Human therapeutics production in yeast, bioenergetics and biological molecular machines, Nanoparticle-based drug delivery and protein-based nanodevices, cancer biology, microRNA biology.

**Bioinformatics and Genomics:** Genome editing with programmable nucleases; analysis and interpretation of next-generation sequencing data; traditional home-medicine and cancer big data analysis.

**Biophotonics:** Development of fluorescence and optical imaging methods for detection of single molecules to the whole cell. Application of these methods for biosensing of pathogenic microbes and cancer cells.

**Agricultural Microbiology:** Plant microbe interactions; biocontrol.

**Electromicrobiology:** Extracellular electron transfer; microbial electrochemistry.

#### **Department of Civil Engineering [Code CEZ]**

**Environmental Engineering :** Urban air quality management; indoor air pollution; water and waste water treatment; Emerging water contaminants (Nano particles, Antibiotics); urban water and waste water Management; Non-point source Pollution; Membrane Biological Treatment Process; Modeling, simulation and

optimization of Environmental systems; Environmental Impact Assessment; Human Health Risk Assessment; solid waste management; incineration waste-to-energy; circulating fluidized bed operations; Landfill Management; Carbon sequestration; sustainable development (Urban cities/growth centres); Environmental Risk Analysis, GIS and Remote Sensing Applications for Environmental Management. Aerosol characterization, local and regional air quality, climate change and health impact.

**Geotechnical Engineering :** Soil Mechanics and Foundation Engineering; Rock Mechanics, Rock Engineering and Underground Structures; Rock Dynamics; Geo-environmental Engineering; Landfills; Ash Ponds and Ash Utilization; Geotechnical Re-utilization of waste; Energy Geotechnology; Slope Stability and Dams; Ground Improvement; Geosynthetics; Reinforced Soils; Soil Dynamics and Earthquake Geotechnics; Foundations for Industrial Machines; Site specific response studies; Engineering Geology; Seismic Hazard Analysis and Microzonation; Expansive Soils; Geophysical Methods; Geotechnology for tracks and pavements; Blast and Impact Analysis; Dynamic Behaviour of Tunnels and Slopes; Landslides in Static and Dynamic Conditions; Offshore Geotechnology; Constitutive Modelling; Numerical Methods; Mechanics of granular materials; Post-Geodisaster Reconnaissance Studies; Bioinspired Geotechnics.

**Structural Engineering :** Analysis and design of structures; tall buildings; bridges; Earthquake engineering; wind engineering; offshore structures; masonry, RCC and steel structures; Construction Management; Construction Technology; Concrete Technology; structural dynamics; structural control; constitutive modeling; computational methods; modeling of damage, plasticity and creep of concrete; durability of concrete; rebar corrosion; modeling of cements; supplementary cementitious materials; use of marble, granite or other waste powder in concrete; composites; high performance concrete; self-compacting concrete; financial analysis; contract administration, quantitative methods in construction management; Infrastructure Project Management Risk and Financial Management; sustainable construction, green building, resilient infrastructure, design management, automation in construction; BIM (Building Information Modeling) in construction projects; structural health monitoring; smart materials and structures; tensegrity structures; biomechanics; engineered bamboo structures; artificial intelligence; damage assessment and strengthening; microstructural modeling; mechanics of composite materials; non-destructive testing and evaluation using ultrasound; subsurface imaging using ultrasonic wave propagation; piezoelectric energy harvesting; radiation damage; nanomechanics; multiscale modeling; fracture and failure modeling; mechanics of glasses & disordered materials; atomistic modeling, machine learning.

**Transportation Engineering :** Transport planning; Transport policy; Transportation safety; Construction work zone safety; Heterogeneous traffic flow modeling; Traffic safety and capacity of hill roads; Mass transportation planning; Urban transport infrastructure planning and design; Non-motorized transport planning; Modeling of pedestrian behavior; Activity-travel behavior analysis; Network modeling; Transportation logistics and optimization; Traffic operations; Geometric design of transportation infrastructure; Characterization of pavement materials; Pavement design (flexible and rigid); Damage modeling of bitumen and bituminous mixtures; Constitutive modeling of pavement materials; Recycling of civil infrastructure materials; Rheology of asphaltic materials; Condition assessment of highway infrastructure; Pavement management systems; Highway engineering; Airport infrastructure.

**Water Resources Engineering :** Hydrology in natural and urban environment; Hydrological modeling and simulation; Stochastic processes; Data mining in hydrology; Flood forecasting and modeling; Snow and glacier hydrology; Snow dynamics; Hydroclimatology; Climate change effects in water resources; Watershed modeling; Large river basin modeling; water resources systems, planning and management; Water allocation; Water resources conflicts; Irrigation management; Flow through porous media; Groundwater modeling; Ground water contamination & remediation; Contaminant transport modeling; Leachate pollution; Bioremediation; River water quality modeling; Environmental impact assessment of water resources projects; Surface and subsurface drainage; Hydraulic structures; Sediment transport; Application of numerical methods, CAD, FEM, GIS, and Remote sensing in Water Resources Engineering. Slurry Pipeline, CFD modeling of Multiphase flows, Economic Analysis of water resources projects; Anomalous Hydro Dynamics; Transport Phenomena.

### **Department of Chemical Engineering [Code CHZ]**

Catalysis and reactor engineering, Multiphase flow & reactors, Control of reactors, Petroleum refining engineering, Computer Aided Design, Computational fluid dynamics, Microfluidics, Hydrodynamic, instability, Particle technology, Mixing, Fluidization, Distillation and other separation processes, Complex fluids, Interfacial engineering, food, Polymers, Polymer rheology, Membrane synthesis & processes, Biomass, Bioseparations and

Bioprocessing, Process operations planning and scheduling, Biosimilars, Quality by design, Protein characterization, Colloids, and interfacial science, Nanotechnology, Biosensors, Renewable energy, Biorenewable Chemicals and Solid Oxide Fuel Cells, Electrochemical process, Hydrogen fuel cells, Lithium-ion batteries, Electrochemical modeling Supercapacitor, Electrochemical energy storage Devices, Flow batteries, Therapeutics, Drug delivery, Waste management, Environmental engineering, Aerosols, Air Pollution, Process systems engineering, Model Predictive control, Process monitoring, Application of machine learning in chemical process modeling and control Structural Bioinformatics, Polymer Informatics, Computational material design, Density Functional Theory and Molecular Dynamics Simulations.

### **Department of Computer Science & Engineering [Code CSZ]**

**Algorithms and Complexity Theory:** Algorithmic graph theory, Computational geometry, Randomized algorithms, Approximation algorithms, Complexity theory, Online algorithms.

**Artificial Intelligence (AI) and Machine Learning (ML):** Reinforcement learning and AI planning, Neuro-symbolic ML, Probabilistic graphical models, Statistical relational learning, Extreme classification, Embodied artificial intelligence, Ethical AI, Fairness and reliability in ML, Privacy issues in ML, ML for social networks, ML applications to healthcare, AI for crowdsourcing, Knowledge-based AI, Computational advertising, AI for robotics.

**Natural Language Processing (NLP):** Intelligent information systems, Information extraction, Question answering, Dialog systems, Knowledge-base completion, Neural architectures for NLP.

**Databases and Data Analytics:** Intention mining, Policy driven databases, Information retrieval, Information dissemination in social networks, Semantic web data management, Opinion mining, Indexing and querying in graph databases, Spatio-temporal data analytics, Data wrangling.

**Architecture and Embedded Systems:** Hardware-software co-design, Embedded systems design, Reconfigurable computing, Fault-tolerant computing, Hardware implementations, Temperature-aware architectures, Energy-efficient architectures, Design-for-debug, Cache memory, 3D and non-volatile memory, Architectural extensions for mobile security, Architectures for machine learning, Architectures for computer vision, Secure architectures.

**Graphics and Vision:** Computer graphics, Virtual reality, Computer vision, Digital image and video processing, Mobile multimedia, Embedded computer vision, Robotic vision, Medical image analysis.

**Computer Networks and Distributed Systems:** Mesh networks, 4G LTE/ WiMAX, Cognitive radio, Cellular network measurements, Wireless networks, Network security, Operating systems security.

**Programming Languages, Semantics and Verification:** Programming language semantics, Theory and practice of concurrent systems, Process algebras, Distributed computing, Program analysis and verification, Logic in computer science, Applications of verification in network models, multiprocessors, and relaxed memory models.

**Operating Systems, High Performance Computing and Systems Software:** Compiler design, mobile operating systems and device drivers, Operating systems for IoT system

**Information and Communication Technologies for Development:** Poverty mapping, Urbanization, Bias in mass media, Computer systems for less-literate populations, Content distribution in rural areas, Community radio, Community media, Mobile health, Governance and accountability.

**Neuroinformatics and Medical informatics:** Functional MRI (fMRI), Electroencephalography (EEG), Near-infrared spectroscopy (NIRS), Human Functional Connectome, Statistical Modeling, Yogic Neuroscience.

**Cyber Security and Secure Information Systems:** Formal notions of security, Formal verification for security, Language-based security, Secure architectures and Embedded systems, Network security, Blockchain-based systems, Privacy and data protection, Electronic voting, Digital identity.

### Department of Chemistry [Code CYZI]

Asymmetric synthesis & catalysis, Biochemistry (Enzyme technology, Microbial Biochemistry, Fermentation & Bio-remediation, Cloning & Proteomics), Bio-inorganic chemistry, Bio-organic chemistry, Bio-physical chemistry, Carbohydrate chemistry, Coordination chemistry, Fluorescence Spectroscopy (Ensemble & Single molecule), Nano-materials (Optical Properties & Photovoltaics), Nano-catalysis in ionic liquids, NMR spectroscopy, Organometallic chemistry, Peptide synthesis, Quantum & Classical computer simulation on chemical & biological systems, Solid state chemistry, Supramolecular chemistry (Molecular Organisation & Recognition), Synthetic & Mechanistic organic chemistry, Theoretical Chemistry.

### Department of Design [Code: DDZI]

Industrial Design, Product Design, Engineering Design, Computer Aided Design and Manufacturing, Design for Product Life-Cycle, Usability, User Experience, Design for Wellness, Design for Sustainability, Design for Environment, Packaging Design, Visual Narratives, Comics Studies, Design for Children Education, Visual Communication, Healthcare Design, Design of Sustainable Habitats, Data Science and Design, Design of Assistive Technologies, Design for Culture, Design for Industry 4.0.

### Department of Electrical Engineering [Code EEZ\*]

**Circuits, Systems and Devices Engineering:** CMOS technology and VLSI design, device modeling, simulation and characterization, device fabrication and reliability, compact modeling and PDKs, nanoelectronics, quantum computing, nanomaterials, nanophotonics, plasmonics, biosensors, fiber-optic and chip based optical sensors, photonic and optoelectronic materials and devices, LEDs and solid state lighting, CMOS image sensors and vision systems, photovoltaics and photodetectors, memory devices and architecture, logic device design, neuromorphic computing and NVRAM technology, machine learning, bio-inspired devices and circuit design, spintronics and micromagnetics, MEMS devices, energy harvesters and piezoelectric devices, low-power analog design, low-cost sensors and flexible electronics, quantum electronics, energy harvesting, measurement and instrumentation, power semiconductor devices, analog and mixed signal circuit design, high speed circuit design, electromagnetics, microfluidics and microplasma.

**Power Engineering :** Electric machines and drives - Electric machine design, control and converter design, Power electronics - converter topology, multilevel converters, magnetic component design, Wide Band Gap device converter design, Power systems - Protection, stability, optimization, power quality, HVDC & FACTS, Computer applications - development and design of control platforms, CAD software for system development, Renewable energy systems - Solar, wind, micro hydro etc

**Communication Engineering:** Signal Processing, Speech and Image Processing, Coding & Information Theory, Communication Systems, Optoelectronics, Optical Communications, Communication Networks, Wireless and Mobile Communications, Microwaves, Antennas.

**Computer Engineering :** Computer Vision, Multimedia Systems, Image Processing, Computer Networks, Computer Architecture, Embedded Systems, Mobile computing, soft computing, Pattern Recognition, Artificial Intelligence, Information Technology, Music information retrieval, Bioinformatics, Brain-computer interface.

**Control Engineering :** Robust Control, Intelligent Control, Robotics, Optimal Control, System Identification, Neuro-Fuzzy Control, Reinforcement Learning Control, Nonlinear Systems and Control, Dynamical Systems, Applications to Biomolecular Circuits, Flight Control and Navigation, Adaptive Control, Cooperative Control and Path Planning, Sensor Fusion, Guidance, Navigation and Flight Control, Sliding Mode Control, Interval Analysis in Control Design, Computational Methods, for Simulation and Control, Modeling and Model Order Reduction, Attitude Control and Structural Control, Numerical Modeling and Simulation Embedded Control System.

*\* Full-time applicants with UGC (JRF), CSIR (JRF) and other government funded fellowships (OGF) will also be considered. Applicants must have a minimum of four-year education after 12th standard with degree in science, engineering or medicine (B. Tech/M. Sc./BE/BS/MBBS) or equivalent.*

### Department of Humanities & Social Sciences [Code HUZ]

Literature, Sociology, Psychology, Linguistics, Philosophy, Economics.

NOTE: Candidates must refer to the Department website (<http://hss.iitd.ac.in/areas>) for details on areas of specialization in which applications will be considered.

### Department of Mathematics [Code MAZ]

Algebra, Cryptography, Numerical Linear Algebra, Number Theory and Combinatorics, Dynamical Systems and Fractals, Topology, Algebraic Topology, Harmonic Analysis, functional Analysis, Operator Theory, Pseudo Differential Operator, Numerical Analysis, Partial and Stochastic Differential Equations, Algorithms and Graph Theory, Machine Translation, Applied Probability, Stochastic Modeling, Queueing Theory, Optimization, Game Theory, Financial Mathematics.

### Department of Mechanical Engineering [Code MEZ]

**Design Engineering:** Mechanical Vibrations, Rotor Dynamics, Damped Structures, Composite Structures, Smart structures, Active Vibration Control, Experimental Modal Analysis & Identification, Structural Dynamic Modification, Finite Element Model Updating, Dynamic Design, Noise Engineering, Condition Monitoring, Bearing Dynamics, Lubrication, Mechanical System Design, Precision Machine Design, Computer Aided Mechanical Design, Computer Controlled Mechanisms, Vehicle Dynamics, Modelling the Impact of Vehicles, Impact Biomechanics, Concurrent Engineering Design, Mechanisms, Robotics (including Medical Robotics) ,Medical Devices/instruments, Multibody Dynamics, Application of Multibody Dynamics in Design and analysis of Rural Engineering Systems, Computational Mechanics ,Fracture Mechanics, Fatigue & Failure analysis ,Experimental solid Mechanics, Mechatronics, Sensors and Actuator Design, MEMS, Design of Microsystems, Nanomechanics, Artificial Intelligence Applications in Mechanical Engineering & Expert Systems for Design & manufacturing and Mechanical Engineering Applications to Medical Science. Public policy and governance ,Transportation (Railways , Freight ).

**Thermal Engineering:** Phenomenological and Multi-dimensional modeling of IC Engines, Fundamental and Applied Combustion, Air Pollution: Characterization and Remediation, Microfluidics, Phase Change, Multiphase Flows, Electrochemical Energy Systems, Fluid-structure Interaction, Bio heat transfer, Rural Energy Systems, Biomass Gasification, Clean Coal Technologies, Solar Cooling, Thermal Comfort, Refrigeration and Air Conditioning System, Computer Simulation and Design of Thermal System, Heat and Mass Transfer Systems, Heat and mass transfer, Porous media Convective drying , Inverse heat transfer, Continuous casting, Pico-hydel power units for rural electrification and production of char using water biomass.

**Production Engineering:** Metal Cutting, Metal Forming, Welding, Metal Casting, Material Characterization, Nontraditional Manufacturing Processes, Measurements & Metrology, Grinding of Ceramics and Metal Matrix Composites, Processing of Polymers & Composites, Injection Molding, Microcellular Injection Molding, Finite Element Applications in Manufacturing, CAD/CAM, Rapid Prototyping, Intelligent Manufacturing, Micro & Nano-Manufacturing, Biomaterials and Medical Implants, Nanocomposites, Modeling of Material Behavior, Lean concepts in Machine Tool Design. Manufacturing Automation, Magnetorheological Finishing .

**Industrial Engineering:** Quality, Reliability and Maintenance, Lean Manufacturing, Agile Manufacturing Productivity Management, Operations Research, Operations Management, Project Management, Supply Chain Management, Applied Probability Models, Decision Support Systems, Value Engineering, Flexible Systems, Healthcare Systems, Intelligent Manufacturing Systems, e-Business, Reverse Logistics, Financial Engineering, Wireless Systems.

### Department of Materials Science and Engineering [Code MSZ]

**Metals:** Structure-property correlation in advanced materials, Fracture and Fatigue, Indentation, nano-scale friction and wear, Material characterization using advanced microscopy, phase transformations, solid-state diffusion controlled reactions, Synthesis and characterization of Metal matrix composites, Light metals and alloys, 3D printed metals and alloys, Auxetic materials, Bulk metallic glasses and composites, functionally graded materials, nanomaterials.

**Polymers:** Synthesis of polymers, structure-property correlation in polymers, rheology and processing of polymers, polymer matrix composites, tribology and mechanical behaviour of polymers, membranes for various applications, antifouling and antibiofouling materials and membranes, redox polymers, materials for energy storage, separation and purification, organic-inorganic hybrid materials, catalytic materials and nanomaterials for catalysis and environmental applications, 2D materials, graphene, Covalent organic frameworks, biodegradable materials, organically modified mesoporous silica nanoparticles, surface engineering using controlled radical polymerization techniques.

**High Temperature Materials:** Advanced ceramics, high entropy alloys, materials for extreme environments, thermal barrier coatings, alloy processing and properties, refractory metals and compounds, aluminide bond coats.

**Computational Materials Science:** Physics- and data-based modeling of materials, First principles based materials design, Molecular modeling of materials, Micromagnetic simulations, Multiscale Simulations, Finite element modeling, Machine learning for materials informatics.

**Electronic Materials:** Semiconductor nanostructures and device applications, magnetic nanowires and magnetic tunnel junctions for spintronics device applications, MEMS/NEMS devices, solar cell, organic electronics.

**Glass and Ceramics:** Optical Glass, toughened and tempered glass, structural and functional ceramics and glass ceramics.

### **Department of Physics [Code PHZI]**

**Materials and Condensed Matter Physics:** Thin Films, Materials and Devices, Novel Functional Magnetic Materials, Nanomaterials, Lattice Dynamics, Semiconductors and Amorphous Materials, Electronics Ceramics, Quantum Functional Materials, Superconductivity, Nanomagnetism and Spintronics, Spin Dynamics, Charge Carrier Dynamics and Electronic Structure Studies of the Correlated Electron Systems, e.g., Fe-based high-Tc superconductors, Complex oxides, Materials for Nuclear Energy, Spectroscopic imaging, Topological Insulator.

**Optics and Photonics:** Holography, High Density Data storage, Liquid crystals, Nonlinear Phase Conjugation, Optical Information Processing, Optical Data Security, Singular Optics, Nonlinear Optics, Nonlinear guided Wave Optics, Solitons, Quantum Optics, Fiber Optics, Integrated Optics, Fiber Optics Sensors and Biosensors, Fiber optics Components, Nanophotonics, Laser Spectroscopy and Applications, Terahertz Spectroscopy and Applications, Ultrafast Dynamics, Laser Processing and Fabrication, Green and Biophotonics, Photonic Metamaterials, Bio-Medical Imaging, Inverse Problems in Imaging, Optoelectronics.

**Plasma Physics:** Particle Acceleration, Nonlinear Waves and Instabilities in Plasma, Thermo Nuclear Fusion, Microwaves and Plasma Interaction, Solitons in Plasma, Space Plasmas, Terahertz (THz) Radiation Generation, Hall Thrusters, Interaction of Plasmas with Materials, Laser Plasma Interaction, Particle and Fluid simulations in Plasma.

### **Computational and Statistical Physics:**

Mathematical, Statistical Mechanics, and Computational Physics, theoretical Studies in ultra-cold atoms, Cavity Opto-mechanics with ultra-cold atoms, Nuclear Physics, Particle Physics, Ultrafast Optics. Soft Condensed Matter and Biophysics, Ion-atom collision physics, Ion-irradiation of biologically relevant molecules.

**Condensed Matter Theory:** Designing Energy Materials, Thermal Transport, Electronic Structure, Band Engineering, Clusters and Catalysis, Pyroelectricity, Piezoelectricity, (Anti) ferroelectricity, (Anti) ferromagnetism, Multiferroics, Spin and Lattice Dynamics, Caloric Effects, Non-collinear Magnetism, Genetic Algorithm, Machine Learning, Force Field, Density Functional Theory, Kinetic Monte Carlo, Molecular Dynamics, etc.

**Quantum Matters and Information System:** Topological classification of semi-metals using experimental and DFT simulations, transport properties of these exotic materials under very low temperature, high magnetic field and high pressures, single crystal Topological Insulator, rare earth based Half Heusler (HH) alloy systems, cold atom based quantum technologies, trapping of cold atoms in optical potentials, controlling the environment induced decoherence, building large scale quantum information processing network, quantum computation protocols for solving industry and society relevant problems, quantum sensing devices and quantum metrology modules for precision instrumentations and measurements, collision of highly charged ions interaction with atoms, molecule of biological interest, clusters and ices of bio-and astrophysical relevance, bio-medical application to estimate the damages to the human DNA/ RNA caused by exposure to ionizing radiation.

**High Energy Physics :** Hot and dense hadronic matter and experimental observables in the nuclear collisions; nuclear astrophysics; Chiral symmetry breaking; Colour superconductivity, Phenomenological analyses of physics beyond the Standard Model in the light of Higgs, Collider, Dark Matter searches, neutrino masses & mixing and charged lepton flavour violation, Phenomenology of the strong force at small x.

## **Department of Management Studies [Code SMZI]**

**Economics:** Managerial Economics, International Economics, Productivity and Efficiency Analysis, Business Forecasting, Economic Feasibility & Techno economic Analysis, Sustainable Development, Socio-economic Analysis, Energy Economics, Econometric Methods and Applications, Macroeconomic Theory and Policy, Security and Information Risk, Merger and Acquisitions, Big Data Analytics, Digital Economy, Development Economics, Public Policy, Environmental Economics and Climate Change.

**Finance:** Financial Analysis and Valuation, Financial Management, International Financial Management, Capital Markets, Derivative Securities, Portfolio Management, Mutual Funds, Banking, Financial Markets and Services, Mergers and Acquisitions, Risk Management, Behavioral Finance, Corporate Governance, Corporate Social Responsibility, Supply chain Finance.

**Human Resource Management:** Organization Management / Behavior / Development, Business Ethics, Leadership.

**Information Systems:** Management of Information Technology, Management Information System, Decision Support System, Social Media, Digitization and Smart Cities, Machine Learning, ICTs, Development and Business, Business Analytics, Electronic Commerce, Sharing / platform economy, e-governance.

**Marketing:** Marketing Management, Industrial and Hi-Tech Marketing, Advertising, Sales promotion.

**Operations:** Production, Management and Operations research, Sustainable and Big Data Operations, International Manufacturing Network, Enterprise Resources Planning, Project Management, Modeling and Simulation of Operations, Healthcare Operations System Analysis, Total Quality Management, Logistics Management.

**Strategy:** Management of Technology, Corporate Strategy, Global Competitiveness, Strategic Innovation, Entrepreneurship, Flexible Systems Management, Business Process Re-engineering, Strategic Business Management, Knowledge Management, International Business, Intellectual Property Rights, Strategic Thinking.

## **Department of Textile and Fibre Engineering [Code TTZI]**

**Textile Engineering :** Design and analysis of yarn and fabric formation systems: rotor spinning, ring spinning, air jet spinning, friction spinning, weaving, knitting, nonwovens, braiding etc. ; Structural mechanics of textiles; High stress elastic materials; Apparels and garments; comfort; handle and other functional aspects of fibrous assemblies; Design and development of technical textiles: geo-textile, filter fabrics, medical textiles, protective textiles, textile composites etc.; Systems analysis; Textile production and marketing: operation management and supply chain managements; Textile production and marketing: operation management and supply chain managements; Textile Instrumentation and machine development; Modeling and simulation of textile processes and products; Quality management.

**Textile Chemical Technology:** Textile chemical processing; preparatory processes; dyeing, printing and finishing, Surface functionalization by plasma and UV excimer lamp; Micro and nano-encapsulation; Conducting textiles; Natural dyes; Bio-active textiles; Textile ecology and environment.

**Fibre Science & Technology:** Synthesis and characterization of advance of advanced polymeric materials; Fibre formation processes; Modeling and simulation; Structure-property correlation; Functional and responsive polymers; Smart & intelligent textiles; Modification of natural and synthetic fibres; Nanotechnology in textiles: nonfibers by electrospinning, nanomaterials; Synthesis and application in textiles; Coated textiles; Polymer nanocomposites; Green Composites; Medical textiles, Tissue engineering; Sustainability and polymer & fibre recycling; 3D Bioprinting; Wearable electronics: Conducting fibres, piezoelectric materials, Supercapacitors, batteries etc

## **Centre for Applied Research in Electronics [Code CRZI]**

**Signal Processing;** Underwater Acoustics, Speech and Audio, General Acoustics, Machine learning, Optimization for Signal Processing, Acoustic Imaging, Multi Sensor Data Fusion, Digital Communications, DSP Algorithms; **Microwaves and RF:** Active and Reconfigurable Circuits and Antennas, Millimeter Wave and T Hz circuits and sub-systems, Microwave imaging; RF MEMS, Wideband Microwave Circuits, Modeling of Active Devices; **Microelectronics:** Micro-Electro-Mechanical Systems (MEMS) Technology,

### **Centre for Atmospheric Sciences [Code ASZI]**

**Mesoscale Modelling:** Numerical Modelling of the Atmosphere, Tropical Meteorology and Indian Monsoon, Land-Surface Process Modelling, Land- Atmosphere Interaction, Renewable Energy Meteorology, Renewable energy resource assessment and forecasting.

**Ocean Modelling:** Ocean Circulation Modelling, Ocean State Simulations and Forecasting, Storm Surges and Inundation, Coastal Ocean Processes, Simulation of Ocean Surface and Internal Waves.

**Climate Modelling:** Global and Regional Climate Modelling, Climate Dynamics, Climate Variability and Changes, Climate Change Detection & Attribution, Climate Projections, Climate Change Impacts on extreme events, health, agriculture, water resources and energy, Aerosol-Cloud-Climate Interactions.

**Air Pollution Modelling:** Urban Meteorology, Chemical Transport Modelling, Health Impact Assessment of Air Pollution, Science of Extreme Weather.

### **Centre for Automotive Research and Tribology [Code CTZI]**

EV technologies (Power train, Charger, charging Infrastructure, etc.), Battery for EVs, Battery management system (BMS), Autonomous and connected vehicles, Vehicle Telematics, Tribodynamics, Tribological and Acoustical materials, Surface Engineering, Condition Monitoring and Reliability.

### **Centre for Biomedical Engineering [Code BMZI]**

Electrical / Electronic/ Instrumentation Engineering; Mechanical/Manufacturing/Production Engineering; Chemistry/ Biochemistry/Polymer Chemistry/ Material Sciences/ Pharmaceutical Sciences; Chemical Engineering; Mathematics/Physics/Bio-Physics; Computer Science Engineering; Biomedical Engineering; Biotechnology, MBBS/BDS/Homeopathy (B.H.M.S)/Physiotherapy (BPT) /Veterinary Sciences.

### **Centre for Energy Studies [Code ESZI]**

Internal Combustion Engines, Thermal Engineering, Solar Thermal, Power Systems, Power Electronics, Machine Drives, Control System and Devices, Instrumentation and Control, Solar Photovoltaics, Wind Energy, Hydro Power, Plasma Science and Technology, Nuclear Engineering, Energy Conservation and Management, Bio Energy, Water Resources Engineering, Turbo Machinery, Materials and Metallurgy, Building Design and Energy Management, Computational Fluid Dynamics (Thermal Fluids).

### **Centre for Rural Development and Technology [Code RDZI]**

Artisan technologies and rural industries; rural energy system; renewable energy technologies; biogas production and enrichment; biofuels, biofertilizers and biopesticides; biomass production, conversion and utilization; environmental microbiology and bioremediation; algal technologies; natural products processing (food, medicinal, aromatic, and cosmeceutical plants); eco-friendly grain storage systems; agro-food processing, storage and value addition; Food safety and quality measurement, 3D Printing of biological materials; bio-formulation for food preservation and storage; isolation, encapsulation and value addition of bioactives; biomass thermo chemical processing; clean cookstoves; solid and liquid waste management; wastewater treatment; wetland reclamation; clean and sustainable technologies; natural fibre products; environmental impact assessment; tissue culture; medicinal mushroom production technologies; panchagavya – processes, validation and standards; application of blockchain technology and nanotechnology in agriculture.

### **Centre for Sensors, Instrumentation and Cyber-physical Systems Engineering [Code: IDZI]**

Electronic and optical sensors, Mechatronics, Optical Metrology, Micro optics, Aspheric and freeform optics, optical instrumentation, Holographic microscopy, Digital speckle pattern interferometry, Optical coherence tomography and optical image processing.

### **National Resource Centre for Value Education in Engineering [NRZI]**

**Holistic Health and Wellness.** All issues pertaining to holistic view of individual's health and wellness. These include modern scientific research on proven mind-body techniques for physical and mental health, such as Mindfulness, Yoga, Tai-Chi, Qi-Gong, Ayurveda, Holistic nutrition and others. Yogic Neuroscience, Indian

Psychology, Cognitive Sciences, Clinical trials on Yoga and Ayurveda, fMRI-based Neuroimaging (fMRI), EEG, MEG, PET, fNIRS.

**Leadership for Sustainable Development.** Various aspects of holistic and sustainable development. Notions of development which go beyond purely material well-being, and consider other aspects of human/societal well-being such as intellectual, emotional and overall happiness. Notions of development which encompass sustained co-existence among human-beings as well as with nature. How to create leadership (in various walks of life – especially in engineering/technology) for taking forward these alternate views on development.

**Inner Development.** Understanding first person mental phenomena, especially those pertaining to Meditation, Mindfulness and Contemplation in a rigorous academic framework. Theoretical frameworks for alternative worldview based on deep contemplative insights. Teaching and research on first person mental phenomena through accurate and reproducible observations.

**Inner and Outer Harmony through Music and Arts.** Classical music, dance and art forms that promote introspection, concentration, various aspects of self-awareness and devotion. Evolution of parallel streams of classical music in India. Development of classical art forms through folk art forms. Societal awareness through classical music. Streams of thought in classical music. Connections between 32ufism32c music and 32ufism. Technology-based analysis and dissemination of music.

**Value Education and Technology.** Teaching the teachers, tools and techniques for inculcating value education to students, especially at tertiary level of science and engineering. Research on effectiveness of various techniques for value education. Newer models of education. Use of technology for large scale dissemination of knowledge.

#### **Amar Nath and Shashi Khosla School of Information Technology [Code ANZI]**

Scalable & Dependable Computing, Information Security, Biometrics, Information Storage and Retrieval, Data Analytics, Social Network Analysis, High Speed Networks, Sensor Networks, Mobile and Web Based Computing, Multimedia Systems, Embedded Systems, VLSI Design Automation, Internet of Things, Image Processing, Computer Vision, Robotics and Intelligent Systems, Medical Applications of IT, Computational and Systems Biology, Computational Neuroscience and Neuroimaging, Assistive Technologies, Human Computer Interfaces, Information and Communication Technologies for Development, Data Science for Development, Computational Sustainability, Geographical Information Systems, Blockchain Technologies, Location Based Services, Other areas aligned with school activities.

#### **Bharti School of Telecommunication Technology and Management [Code BSZI]**

Telecom Networks, Telecom Software, Wireless Technologies, Optical Networks, Signal Processing, Telecom Systems Design, Planning and Management, Regulatory and Policy Aspects of Telecom Services and Systems, Embedded Telecom Systems, Telecom Network Management, Performance Analysis of Communication System and Resource Management, Wireless Security, Machine learning for wireless communication, Internet of Things.

#### **School of Interdisciplinary Research [Code SRZI]**

IITD faculty from two or more different Departments/Centres/Schools define Interdisciplinary Research problems as projects. The student selection is done for specific projects advertised periodically on the School website ([sire.iitd.ac.in](http://sire.iitd.ac.in)); the student is supervised by all the concerned faculty.

#### **School of Public Policy [Code PPZI]**

Energy, Environment, Agriculture, Industry, Digital Information Society. Candidates must refer to the School website (<http://spp.iitd.ac.in/academic/phd>) for details.

#### **Kusuma School of Biological Sciences [Code BLZI]**

Computational Biology, Systems Biology, Chemical Biology, Cellular Biophysics, protein folding & misfolding with focus on infectious diseases and non-communicable disorders, Chaperone assisted protein folding, Molecular biophysics of protein folding, unfolding and conformational properties, Cognitive and computational neuroscience, Viral diseases, Nanoparticle-based targeting, Structural Biology, Diagnostic

Virology, Cancer Biology, Plant-based therapeutics, Marine Bioprospecting, insulin signaling and insulin resistant diabetes, Leishmaniasis, ion channel and receptor biology, Host pathogen interaction.

**Transportation Research & Injury Prevention Programme [Code TRZ]**

Transportation Planning; Traffic flow modeling and optimization, public transport systems; Sustainable Urban Transport; Travel Behaviour Modeling; Pedestrian Dynamics and Evacuations; Construction Safety and Work Zone Safety; Highway Safety; Vehicle Crash Modeling; Road Traffic Injury Prevention; Human Body Modeling and injury estimation; Pedestrian and non-motorized vehicle safety; Urban Freight, Road accident costing.

**M.Tech./M.S.(Research) and M. Des. Programmes offered**

<b>Department/Centre/School</b>	<b>Programme</b>	<b>Code</b>
<b>[A] M. Tech. Programmes of Deptts./Centre/ School</b>		
Applied Mechanics	Engineering Analysis and Design	AMA
Applied Research in Electronics	Radio Frequency Design and Technology	CRF
Atmospheric Science	Atmospheric-Oceanic Science & Technology	AST
Biomedical Engineering <sup>#</sup>	Biomedical Engineering	BMT <sup>#</sup>
Chemistry	Molecular Engineering; Chemical Synthesis and Analysis	CYM
Chemical Engineering	Chemical Engineering	CHE
Civil Engineering	Construction Engg. & Management	CET
	Environmental Engineering and Management	CEV
	Geotechnical and Geoenvironmental Engg	CEG
	Rock Engineering and Underground Structures	CEU
	Structural Engineering	CES
	Transportation Engineering	CEP
	Water Resources Engineering	CEW
Computer Science and Engineering*	Computer Science and Engineering	MCS*
Electrical Engineering	Communications Engineering	EEE
	Computer Technology	EET
	Control & Automation	EEA
	Integrated Electronics & Circuits	EEN
	Power Electronics, Electrical Machines & Drives	EET
	Power Systems	EES
Energy Studies	Energy & Environment Technology and Management	ESN
	Renewable Energy Technologies and Management	ESR
Materials Science and Engineering	Materials Engineering	MSM
	Polymer Science & Technology	MSP
Mechanical Engineering	Mechanical Design	MEM
	Industrial Engineering	MEE
	Production Engineering	MEP
	Thermal Engineering	MET
Physics	Applied Optics	PHA
	Solid State Materials	PHM
Textile and Fibre Engineering	Fibre Science & Technology	TTF
	Textile Engineering	TTE
	Textile Chemical Processing	TTC
<b>[B] Interdisciplinary M. Tech. Programmes</b>		
M. Tech. Programmes	Energy Studies	JES
	Instrument Technology	JID
	Industrial Tribology & Maintenance Engineering	JIT
	Opto-Electronics & Optical Communication	JOP
	Telecom Technology & Management	JTM
	VLSI Design Tools & Technology	JVL**

Department/Centre/School	Programme	Code
<b>[C] M.S. (Research)</b>		
	Applied Mechanics	AMY
	Biochemical Engg. & Biotechnology	BEY
	Civil Engineering	CEY
	Chemical Engineering	CHY
	Computer Science and Engineering	CSY*
	Electrical Engineering	EEY@
	Materials Science and Engineering	MSY
	Mechanical Engineering	MEY
	Amar Nath and Shashi Khosla School of Information Technology	SIY
	Bharti School of Telecommunication Technology and Management	BSY
	Kusuma School of Biological Sciences	BLY
	VLSI Design Tools & Technology	JVY
	Sensors, Instrumentation and Cyber-physical Systems Engineering	IDY
<b>[D] M. Des. Programme</b>	Industrial Design	DDS
<b>[E] M. Sc. Programme</b>		
Humanities & Social Sciences	Economics	HES
	Cognitive Science	HCS

\*Admission to M. Tech. Programme in Computer Science and Engineering (MCS) is limited to candidates having a Qualifying degree in Computer Science and Engineering, Electrical Engineering, Information Technology, M.Sc. Operations Research, Electronic and Communication, M.Sc. M.A/M.Sc. Math, M.Sc. Math (with exposure to appropriate level course Computer Science) and MCA (with Math and Science at B.Sc. level).

\*Admission to M.S (Research) Programme in Computer Science and Engineering Department (CSY) is to candidates who have a Qualifying degree in Computer Science and Engineering, Electrical Engineering, Information Technology, M.Sc. Operations Research, Electronic and Communication, M.Sc. M.A/M.Sc. Math, M.Sc. Math (with exposure to appropriate level course in Computer Science) and MCA (with Math and Science at B.Sc. level).

In addition to the above, both the programmes (MCS and CSY) are limited to candidates who have appeared in GATE with Computer Science and Engineering or Information Technology.

\*\* M. Tech. programme in VLSI Design Tools and Technology is an interdisciplinary programme jointly offered by Electrical Engg. Deptt., Computer Science and Engineering Department & Centre for Applied Research in Electronics. The M. Tech. programme is wholly sponsored by industries such as Texas Instruments, Cadence Design Systems, Cypress Semiconductors and Qualcomm. The Students will get a monthly fellowship as per rules. Candidate applying for admission to this programme should have basic degree in Computer Science (B.Tech. or equivalent) or Electrical Engineering (B.Tech. or equivalent) or Physics with electronics specialization (M.Sc. or equivalent) plus GATE.

# For M. Tech. in Biomedical Engineering, the eligibility criteria for bachelors in medicine, dental sciences, veterinary sciences, and pharmacy shall be either GATE (if available) or other GATE equivalent national examinations. In other disciplines (Engineering subjects), requirement of a GATE score shall be as per institute norms.

@ Applicants to EEY(MS (Research)) program must have a minimum of four-year education after 12th standard with degree in science, engineering or medicine (B. Tech/M. Sc./BE/BS/MBBS) or equivalent

### ANNEXURE-III

#### OPTIONS FOR M. TECH., M.S. (RESEARCH) & M.DES. PROGRAMMES ACCORDING TO THE DISCIPLINE IN WHICH THE CANDIDATE HOLDS THE QUALIFYING DEGREE

Programme Code (As defined in Annexure-II)	Disciplines of Qualifying Degree
AMA	Aerospace Engineering, Chemical Engineering, Civil Engineering, Industrial Engineering, Mechanical Engineering, Mining, Materials Science & Engineering, Marine Engineering, Naval Architecture, Production Engineering,
AMY	Aerospace Engineering, Chemical Engineering, Civil Engineering, Mechanical Engineering, Marine Engineering, Naval Architecture, Production Engineering,
AST	B.E./B.Tech. Agricultural Engineering, Chemical Engineering, Civil Engineering, Environmental Engineering, Mechanical Engineering. Candidates having B.Tech./B.E. in other branches of engineering will be considered only if they have appropriate experience in related areas of atmospheric and oceanic Sciences, meteorology, remote sensing, etc. OR M.Sc. Meteorology/ Atmospheric Sciences/ Oceanography, M.Sc. Physics/ Geo-Physics/ Marine Engineering/ Statistics/ Chemistry; M.A./ M.Sc. Maths, MCA, M.Sc. Environmental/Agricultural Sciences, M.Sc. Geo-Information/Remote sensing. Candidates with M.A/M.Sc/MCA qualifying degree in subjects other than Meteorology/ Atmospheric Sciences/ Oceanography are required to have taken both maths and physics at least at the undergraduate level.
BEY	Biochemical Engineering, Biochemistry, Biotechnology, Bioinformatics, Biophysics, Biosciences, Chemical Engineering, Chemistry, Environmental Engineering, Environmental Science, Food Science and Engineering, Food Technology, Genetics, Industrial Biotechnology, Life Sciences, Microbiology, Pharmaceutical Biotechnology
BMT	B.Tech. / B.E. in Biomedical, Chemical, Computer Science, Electrical, Electronics and communications, Instrumentation and Mechanical Engineering, Engineering Physics, Biochemical and Biotechnology engineering, Materials Science. OR M.Sc. or equivalent in Biotechnology, Chemistry, Electronics, Materials Science, Mathematics, Polymer science and technology, Physics OR M.B.B.S/ B.D.S./ Bachelor in Veterinary Sciences/ B.Pharm. (duration 4 years and more)
BSY	Computer Science/Computer Science & Engineering, Electronics & Communication, Information Technology, Instrumentation Engineering, M.Sc. Physics with specialization in Electronics, Electrical Engineering
BLY	Bachelor's or Master's degree in any Engineering discipline. OR Bachelor's(Four-year programme) or Master's degree in Chemistry, Physics, Mathematics or Life Sciences
CEC	Selection only jointly with L&T: Civil, Electrical, Mechanical

CEG	Civil Engineering,
CEP	Architecture, Civil Engineering, Mechanical Engineering,
CES	Civil Engineering,
CET	Architecture, Civil Engineering,
CEU	Civil Engineering, Mining Engineering,
CEV	Biochemical Engineering/ Biotechnology, Chemical Engineering, Civil Engineering, Environmental Engineering,
CEW	Agricultural Engineering, Civil Engineering,
CEY	Civil Engineering,
CHE	All areas of Chemical Engineering and allied disciplines
CHY	All areas of Chemical Engineering and allied disciplines
CRF	Electrical Engineering, Electronics & Communication, Engineering Physics,
CSY	Computer Science/Computer Science & Engineering, Electrical Engineering, Electronics & Communication, Information & Technology, M.Sc. Statistics, M.A./M.Sc. Maths, M.Sc. Mathematics/with an exposure to appropriate level course-in Computer Technology,
DDS	Design, Architecture, Any Branch of Engineering.
EEA	Aeronautical Engineering, Automobile Engineering, Biochemical Engineering/ Biotechnology, Chemical Engineering, Computer Science/Computer Science & Engineering, Electrical Engineering, Energy Engineering, Electronics & Communication, Instrumentation Engineering, Mechanical Engineering,
EEE	Computer Science/Computer Science & Engineering, Electrical Engineering, Energy Engineering, Electronics & Communication,
EET	Computer Science/Computer Science & Engineering, Electrical Engineering, Energy Engineering, Electronics & Communication, Informational Technology, Instrumentation Engineering, M.Sc. Mathematics/with an exposure to appropriate level course-in Computer Technology, M.Sc. Physics with specialization in Electronics,
EEN	Computer Science/Computer Science & Engineering, Electrical Engineering, Energy Engineering, Electronics & Communication, Instrumentation Engineering, Informational Technology, Engineering Physics, M.Sc. Physics, M.Sc. Physics with specialization in Electronics,
EEP	Computer Science/Computer Science & Engineering, Electrical Engineering, Energy Engineering, Electronics & Communication, Instrumentation Engineering,
EES	Computer Science/Computer Science & Engineering, Electrical Engineering, Energy Engineering,
EEY	Computer Science/Computer Science & Engineering, Electrical Engineering, Engineering Physics, Informational Technology, Instrumentation Engineering, M.Sc. Physics with specialization in Electronics, Electronics & Communication,
ESN	B.Tech./B.Engg. in Chemical Engineering, Electrical Engineering, Electrical & Electronics Engineering, Engineering Physics, Energy Engineering, Mechanical Engineering, M.Sc. in Physics, Applied Physics, Electronics.
ESR	4-year Bachelors Degree in Chemical Engineering, Civil Engineering, Electrical Engineering, Electrical & Electronics Engineering, Electronics

	and Communication Engineering, Electronics Engineering, Electronics and Instrumentation Engineering, Energy Engineering, Engineering Physics, Industrial Engineering, Industrial Physics, Mechanical Engineering, Power Engineering, Renewable Energy Engineering, Masters Degree in Physics, Electronics and Applied Physics.
IDY	Electrical Engineering, Engineering Physics, Instrumentation Engineering, Mechanical Engineering, M.Sc. Physics
JES	B.Tech./B.Engg. in Chemical Engineering, Electrical Engineering, Electrical & Electronics Engineering, Engineering Physics, Energy Engineering, Mechanical Engineering, M.Sc. in Physics, Applied Physics, Electronics.
JID	Electrical Engineering, Engineering Physics, Instrumentation Engineering, Mechanical Engineering, M.Sc. Physics
JIT	Aeronautical Engineering, Automobile Engineering, Industrial Engineering, Mechanical Engineering, Mining Engineering, Manufacturing Science & Engg., Marine Engineering, Production Engineering,
JOP	Computer Science/Computer Science & Engineering, Electrical Engineering, Electronics & Communication, Engineering Physics, M.Sc. in Physics/ Electronics/ Electronic Sciences.
JTM	Computer Science/Computer Science & Engineering, Electronics & Communication, Instrumentation Engineering, M.Sc. Physics with specialization in Electronics, Electrical Engg.
JVL	Computer Science/Computer Science & Engineering, Electrical Engineering, Engineering Physics, Informational Technology, Instrumentation Engineering, M.Sc. Physics, M.Sc. Physics with specialization in Electronics
JVY	Computer Science/Computer Science & Engineering, Electronics & Communication, Instrumentation Engineering, M.Sc. Physics with specialization in Electronics, Electrical Engineering
MCS	Computer Science/Computer Science & Engineering, Electrical Engineering, Electronics & Communication Engineering, Information Technology, M.Sc. Statistics, M.A./M.Sc. Maths, M.Sc. Mathematics/with an exposure to appropriate level course-in Computer Technology
MEM	Aeronautical Engineering, Agricultural Engineering, Automobile Engineering, Instrumentation Engineering, Mechanical Engineering, Metallurgy, Mining Engineering, Marine Engineering, Naval Architecture, Production Engineering, Textile Engg./Technology,
MEE	Aeronautical Engineering, Agricultural Engineering, Automobile Engineering, Biochemical Engineering/ Biotechnology, Chemical Engineering, Civil Engineering, Computer Science/Computer Science & Engineering, Electrical Engineering, Food Engineering Technology, Industrial Engineering, Informational Technology, Instrumentation Engineering, Mechanical Engineering, Metallurgy, Mining Engineering, M.Sc. Operations Research, Manufacturing Science & Engg., M.Sc. Statistics, M.A./M.Sc. Maths, M.Sc. Mathematics/with an exposure to appropriate level course-in Computer Technology, MCA (With Maths and Science at B.Sc. level), Production Engineering, Textile Engg./Technology, Electronics & Communication
MET	Architecture, Aeronautical Engineering, Automobile Engineering, Chemical Engineering, Environmental Engineering, Food Engineering

	Technology, Mechanical Engineering, Metallurgy, Marine Engineering, Production Engineering,
MEP	Aeronautical Engineering, Agricultural Engineering, Automobile Engineering, Industrial Engineering, Mechanical Engineering, Metallurgy, Manufacturing Science & Engg., Polymer and Rubber Technology, Production Engineering, Textile Engg./Technology, B.Tech in Tool Design
MEY	Industrial Engineering, Mechanical Engineering, Manufacturing Science & Engg., Production Engineering,
MSM	B.Tech. in Materials Engineering, Metallurgical Engineering, Ceramic Engineering, Mechanical Engineering
MSP	Chemical Engineering, Engineering Physics, Industrial Engineering, Mechanical Engineering, M.Sc. Physics, M.Sc. Chemistry, Polymer and Rubber Technology, Textile Chemistry, Fibre Science and Technology, Textile Technology, Nanoscience and Nanotechnology, Petroleum Engineering, M.Sc. Polymer Science, M.Sc. Material Science and Engineering, M.Sc. Material Science
MSY	B.Tech in Materials Engineering, Metallurgical Engineering, Ceramic Engineering, Mechanical Engineering, M.Sc Physics, M.Sc Materials Science.
PHA	Electrical Engineering, Electronics & Communication, Engineering Physics, M.Sc. Physics, M.Sc. Physics with specialization in Electronics,
PHM	Electrical Engineering, Electronics & Communication, Engineering Physics, M.Sc. Physics, M.Sc. Physics with specialization in Electronics,
SIY	Civil Engineering, Computer Science/Computer Science & Engineering, Electrical Engineering, Electronics & Communication, Engineering Physics, Energy Engineering / Energy System / Associated Disciplines, Industrial Design, Industrial Engineering, Information Technology, Instrumentation Engineering, Mechanical Engineering, M. Sc. Operations Research, Manufacturing Science & Engg, M. Sc. Statistics, M. A. / M. Sc. Maths, MCA (with Maths and Science at B. Sc. Level), M. Sc. Physics with specialization in Electronics, Production Engineering, And other engineering disciplines aligned with school activities.
TTC	Biochemical Engineering / Biotechnology, Chemical Engineering, Engineering Physics, Polymer and Rubber Technology, Textile Chemistry, Textile Engg. / Technology, Material Science, M.Sc. Physics and M.Sc. Chemistry
TTE	Mechanical Engineering, Manufacturing Science & Engg., Production Engineering, Textile Engg./Technology, Apparel Tech.
TTF	Biochemical Engineering / Biotechnology, Chemical Engineering, Polymer and Rubber Technology, Textile Chemistry, Textile Engg. / Technology, Material Science, M.Sc. Physics and M.Sc. Chemistry

**GATE Score cut off<sup>#</sup> for admission to non-sponsored full-time  
M.Tech. Programmes in Academic Year 2019-2020**

(This is only for reference as the cut off<sup>#</sup> this year may change substantially)

S.NO.	M.Tech. Programme	Code	GATE Paper/ B. Tech. Discipline	GEN	EWS	OBC	SC	ST	PH
1.	Engineering Analysis and Design	AMA	All	700	700	650	450	450	450
2.	Biomedical Engineering	BMT	M.Sc. Biotech	625	575	575	500	500	500
			B.E./B.Tech Biotech	625	575	575	500	500	500
			B.E./B.Tech Others	550	500	500	450	450	450
3.	Radio Frequency Design & Technology	CRF	ECE	660	600	620	440	350	345
4.	Atmospheric-Oceanic Science Technology	AST	CE/CH and others	550	550	550	450	450	450
			M.Sc.	350	350	350	250	250	250
5.	Molecular Engg; Chemical Synthesis and Analysis	CYM	CY	550	550	500	450	450	450
6.	Chemical Engineering	CHE	Direct Admission	765	765	690	575	500	575
			Interview Shortlisting	600	600	550	475	400	475
7.	Construction Engg. & Mgmt.	CET	CE	300	300	300	200	200	200
8.	Environmental Engg. & Mgmt.	CEV	CE	300	300	300	200	200	200
9.	Rock Engg. & Underground Structure	CEU	CE	300	300	300	200	200	200
10.	Geotechnical and Geoenvironmental Engg.	CEG	CE	300	300	300	200	200	200
11.	Structural Engineering	CES	CE	300	300	300	200	200	200
12.	Water Resources Engg.	CEW	CE	300	300	300	200	200	200
13.	Transportation Engg.	CEP	CE	300	300	300	200	200	200
14.	Computer Sc. and Engg.	MCS	Direct Admission	900	900	900	900	900	900
			Interview Shortlisting	800	720	720	550	550	550

15.	Communications Engg.	EEE	EE/EC	740	740	690	500	375	390
16.	Computer Technology	EET	IT/CS/EC/EE Other	740	730	670	485	390	345
17.	Control & Automation	EEA	EE/EC/ Others	750	750	730	585	500	400
18.	Integrated Electronics & Circuits	EEN <sup>@</sup>	EE/EC	775	775	720	530	350	350
19.	Power Electronics, Electrical Machines & Drives	EEP	EE/ Others	785	785	780	640	585	350
20.	Power Systems	EES	EE /Others	753	743	750	612	545	420
21.	Mechanical Design	MEM	ME	725	650	650	500	300	300
22.	Industrial Engineering	MEE	ME	725	650	650	500	300	300
23.	Production Engineering	MEP	ME	725	650	650	500	300	300
24.	Thermal Engineering	MET	ME	725	650	650	500	300	300
25.	Material Sci. & Engg.	MSM	Meta. Engg	425	425	425	350	350	350
			Mech. Engg	675	675	675	600	600	600
			Chem. Engg	425	425	425	350	350	350
26.	Applied Optics	PHA	PH	350	350	315	235	235	235
			EE/EC	700	700	630	455	455	455
27.	Solid State Materials	PHM	PH	400	350	360	260	260	260
			EE/EC	700	700	630	455	455	455
28.	Textile Engineering	TTE	BE/B.Tech.	450	450	405	300	300	300
			M.Sc.	600	600	540	400	400	400
29.	Fibre Science & Tech.	TTF	BE/B.Tech.	450	450	405	300	300	300
			M.Sc.	600	600	540	400	400	400
30.	Textile Chemical Processing	TTC	BE/B.Tech.	450	450	405	300	300	300
			M.Sc.	600	600	540	400	400	400
31.	Energy Studies	JES	BE/B.Tech.	650	650	650	400	400	400
			M.Sc.	450	450	450	350	350	350
32.	Energy & Environment Technologies and Management	ESN	BE/B.Tech.	650	650	650	400	400	400
			M.Sc.	450	450	450	350	350	350
33.	Industrial Tribology & Maintenance Engg.	JIT	Test/Interview	715	175	645	530	400	400
34.	Instrument Technology	JID	EE/TCE/ Control	675	675	620	450	450	450
			ME	620	570	570	425	425	425
			PH	450	450	425	400	400	400
35.	Optoelectronics & Optical Communication	JOP	EE/EC	730	700	680	500	420	350
			PH	350	350	315	230	230	210
36.	Polymer Science & Tech.	JPT	CY	350	350	350	280	280	280
			TF, Polymer	500	500	500	400	400	400

			CH, Petro	600	600	600	480	480	480
37.	Telecom. Tech & Mgmt.	JTM	(All)	700	700	660	520	350	340
38.	VLSI Tool Design & Technology	JVL	EC	790	790	790	740	740	740
			EE	845	845	845	795	795	795
			CS	655	655	655	605	605	605
			IN	770	770	770	720	720	720
			Others	850	850	850	800	800	800
39.	Industrial Design (M.Des.)	DDS*	B.Arch./ B.E./B.Tech. or equivalent	45	38	40	38	30	30

\*CEED Percentile

#as per shortlisting criteria

@PH and IN scores will also be admissible w.e.f. 2020-21

## Pattern and the syllabus of the written admission test for M.Sc. in Economics

**Pattern:** The test will be based on Multiple Choice Questions (MCQs) comprising four sections: (A) Economics (40 marks), (B) Mathematics (20 marks), (C) General analytical (20 marks), and (D) English comprehension (20 marks). The merit list will be based on aggregate of all four sections (100). The medium for the test paper will be English only. The duration of the examination is 3 hours. There is no negative marking. The syllabi of Economics and Mathematics are given below.

*Note: This is a suggestive syllabus only. The questions may not be limited to the list of topics given here.*

### Syllabus: Microeconomics (10+2+3 level):

1. Consumer theory - Preference; utility and representation theorem; budget constraint; choice; demand (ordinary and compensated); Slutsky equations; choice under risk and uncertainty; revealed preference axioms.
2. Production, costs with perfectly competitive markets - Technology; isoquants; production with one and more variable inputs; returns to scale; short run and long run costs; cost curves in the short run and long run; perfect competition in markets.
3. General equilibrium and welfare - Equilibrium and efficiency under pure exchange and production; welfare economics; theorems of welfare economics.
4. Market structure - Monopoly; pricing with market power; price discrimination (first, second and third); monopolistic competition and oligopoly.
5. Game theory - Strategic form games; Nash equilibrium; mixed extension and mixed strategy Nash equilibrium; iterated elimination of dominated strategies; examples: Cournot, Bertrand duopolies, Prisoner's dilemma; cooperative game theory: Shapley value; Nash bargaining.
6. Public goods and market failure - Externalities; public goods and markets with asymmetric information (adverse selection and moral hazard); VCG mechanism and transfer rules.

### Macroeconomics (10+2+3 level):

1. Introduction to macroeconomics and national income accounting for closed and open economy; balance of payments: current and capital account.
2. Money, banking and inflation, Phillips curve.
3. Simple Keynesian Model of income determination and the multiplier, IS-LM Model.
4. Models of aggregate demand and aggregate supply; applications to labour market and wage determination.
5. Elementary open economy macroeconomics.
6. Harrod-Domar, Solow and neoclassical growth models, optimal intertemporal choice for consumption saving tradeoffs, overlapping generations.

### Statistics (10+2+3 level):

1. Probability theory, Sample spaces and events; axioms of probability and their properties; conditional probability and Bayes' rule; independent events
2. Random variables and probability distributions, probability distributions; expected values and functions of random variables; properties of commonly used discrete and continuous distributions
3. Random sampling; Density and distribution functions for jointly distributed random variables; computing expected values of jointly distributed random variables; covariance and correlation coefficients
4. Point and interval estimation, estimation of population parameters using methods of moments and maximum likelihood procedures; properties of estimators; confidence intervals
5. Hypothesis testing; distributions of test statistics; testing hypotheses related to population parameters; Type I and Type II errors; the power of a test; tests for comparing parameters from two samples

### Indian Economy (10+2+3 level):

1. Indian economy before 1950: Transfer of tribute; deindustrialization of India.
2. Planning and Indian development: Planning models; relation between agricultural and industrial growth; challenges faced by Indian planning.
3. Indian economy after 1991: Balance of payments crisis in 1991; major aspects of economic reforms in India after 1991; reforms in trade and foreign investment.
4. Banking, finance and macroeconomic policies: aspects of banking in India; CRR and SLR; financial sector reforms in India; fiscal deficit; savings and investment rates in India.
5. Inequalities in social development: India's achievements in health, education and other social sectors; disparities between Indian States in human development.
6. Poverty: Methodology of poverty estimation; Issues in poverty estimation in India.
7. India's labour market: unemployment, labour force participation rates.

### **Mathematics (10+2+3 level):**

1. Preliminaries and Functions of one real variable
  - a. Set theory and number theory; Graphs; elementary types of functions: quadratic, polynomial, power, exponential, logarithmic; sequences and series: convergence, algebraic properties and applications;
  - b. Continuous functions: characterisations, properties with respect to various operations and applications;
  - c. Differentiable functions: characterisations, properties with respect to various operations and applications;
  - d. Second and higher order derivatives: properties and applications.
2. Single-variable optimisation
  - a. Geometric properties of functions: convex functions, their characterisations and applications; local and global optima: geometric and calculus-based characterisations, and applications.
3. Linear algebra
  - a. Vector spaces: algebraic and geometric properties, scalar products, norms, orthogonality; linear transformations: properties, matrix representations and elementary operations; systems of linear equations: properties of their solution sets; determinants: characterisation, properties and applications.
4. Functions of several real variables
  - a. Geometric representations: graphs and level curves; differentiable functions: characterisations, properties with respect to various operations and applications; second order derivatives: properties and applications; the implicit function theorem, and application to comparative statics problems; homogeneous and homothetic functions: characterisations and applications.
5. Multivariate optimisation
  - a. Convex sets; geometric properties of functions: convex functions, their characterisations, properties and applications; further geometric properties of functions: quasi-convex functions, their characterisations, properties and applications; unconstrained optimisation: geometric characterisations, characterisations using calculus and applications; constrained optimisation with equality constraints: geometric characterisations, Lagrange characterisation using calculus and applications; properties of value function: envelope theorem and applications.
6. Linear programming
  - a. Graphical solution, matrix formulation, duality, economic interpretation.
7. Integration, differential equations, and difference equations
  - a. Definite integrals, indefinite integrals and economic applications; first order difference equations, equilibrium and its stability; first order differential equations, phase diagrams and stability.

## **Additional Important Information for Candidates**

- Ragging in any form is banned in IIT Delhi.
- The Institute treats ragging as a cognizable offence and stern action will be taken against the offenders.
- IIT Delhi will not be responsible for any postal delays.
- All matters of disputes will be subject to legal jurisdictions of the courts in Delhi only.
- The Institute reserves the right to amend, without any notice, any provisions stated in this brochure.