1. ADMISSIONS THROUGH JEE-2010

1.1 INTRODUCTION

The Indian Institutes of Technology (IITs), Institute of Technology, Banaras Hindu University (IT-BHU), Varanasi, and Indian School of Mines (ISM), Dhanbad are institutions of national importance. These institutes play a leading role in technological manpower development and have excellent research programmes. The admissions to the Undergraduate Programmes for all Indian and Foreign nationals at these institutions are made through the Joint Entrance Examination (JEE).

All these institutions are known for providing quality education in science and technology and for research in frontier areas. The environment at these institutions is highly conducive for

- building a solid foundation of knowledge,
- development of personality, confidence building, self-discipline and pursuit of excellence,
- enhancement of creativity, motivation and drive.

All of the above help to prepare the students admitted to these institutions for successful professional and social lives. Today, alumni of these institutions occupy key positions in industry and academia in India and abroad.

Each institute has state of the art laboratories, computer networks, library and access to digital library resources. Teaching methods rely on direct personal contact between the teacher and the students along with the use of traditional and modern instructional techniques. Students live in a pleasant and intellectually stimulating environment with people having similar goals and aspirations hence providing an exciting and unique experience.

Credit-based academic programmes offer flexibility to students to progress at their own pace. A minimum level of performance is necessary for satisfactory progress. The medium of instruction is English. These institutions offer courses leading to Bachelor's degree in a number of engineering, technological and scientific disciplines.

M.Sc. Integrated courses in pure and applied sciences and M.Tech. Integrated courses in a few disciplines are also offered by most of these institutes. In addition, most institutes offer Dual Degree M.Tech. programmes wherein both B.Tech. and M.Tech. degrees are awarded at the end of the programme. The number of seats available in each institute for various courses through JEE-2010 for various categories of students is given in **Table-1**. **Table-2** gives the starting and ending ranks for different courses for the year 2009. The details of fees corresponding to the different institutes are given in **Table-3**.

1.2 ALLOTMENT OF COURSES

Candidates who qualify with a good all India rank (AIR) or category rank can be allotted courses in any of the Fifteen IITs, IT-BHU Varanasi, or ISM Dhanbad depending strictly on the basis of the all India rank he/she gets based on the performance in JEE 2010 as well as the courses he/she selects in order of preference during counselling. For example, a candidate with AIR 558 will be considered for seat allotment after all candidates with AIR less than or equal to 557 have been considered for seat allotment. For every candidate, if his/her first choice is available, he/she is allotted that choice. Otherwise further choices, strictly in order of the declared preferences in the choice sheet, are considered. The highest choice available is allotted to the candidate and all subsequent choices are ignored. If the candidate does not give sufficient choices, he/she may not get any seat. It may, however, be mentioned that the final seat allocation is not done during counselling. On the days of counselling only the duly filled-in choice sheets are collected from the candidates. The allocation will be done centrally. There is no provision for instant seat allocation at the time of counselling.

The choices given by the candidates during the counselling are final and cannot be changed at a later time. Thus, in their own interest, candidates must fill in a sufficiently large number of choices of courses in the decreasing order of preference. To take care of possible dropouts, the number of candidates called for counselling is more than the number of seats available in the participating institutes. The fact that an applicant has qualified in JEE-2010 and has been called for identity verification and counselling does not guarantee admission to him/her.

Although there is a provision for change of branch within the institute where the candidate is admitted, candidates are advised not to count on such possibilities while filling up the choice sheet. The rules for branch change for different institutes are given in **Section 2. However, change of Institute is not allowed under any circumstances.**

1.3 COUNSELLING PROCEDURE

Candidates who qualified in JEE 2010 are required to fill the **on-line form** for their choice of courses offered by the participating institutes as detailed in **Table-1**. The on-line form can be accessed at the counselling websites for which a link has been provided in all JEE websites. One can download

this from the Counselling Website through the link. Candidates must take a print out of the filled form, sign and get it countersigned by parent/guardian.

Please note that the GE/OBC(CL) candidates are not required to come to any of the IITs in person for counselling. Candidates belonging to all other categories must personally come to the counselling institute for certificate verification.

The detailed counselling procedure, to be followed by GE/OBC(CL) candidates, is given in **Section 1.3.1**. The details of counselling procedure for candidates other than GE/OBC(CL) are given in **Section 1.3.2**. Candidates can download the full Counselling Brochure in ".PDF" format from any of the JEE websites.

1.3.1 Candidates Belonging to GE/OBC(CL) Categories

Candidates can Log on to the "On-line Counselling" web site from any of the JEE websites given on the inside back cover of this brochure. From the links provided on the webpage, information can be obtained about various courses being offered in the different participating institutes. A candidate will also be able to get information about the opening and the closing ranks for different courses for the year 2009. The opening and the closing ranks (All India Rank) for JEE-2009 are only indicative and there is no guarantee that for a given AIR, the course which was available last year will also be available this year.

The choices of courses in the order of priority must be filled up using appropriate links at this site. Candidates must also ensure that he/she fulfills all the requirements for the courses opted for in his/her choice sheet (Refer **Sections 1.5 & 1.6**).

One can enter as many courses as one wishes. The larger the list the better is the chance of getting some course in an institute for a given rank. Once a candidate has completed the choice list, he/she can submit the list on-line after verification. The printed copy (hard copy) of the choice sheet should be signed by the candidate and his/her parent/guardian. This should be sent along with a Demand Draft for Rs.1,000/-, drawn in favour of "Chairman JEE" of zonal IIT. This fee is non-refundable. The documents mentioned below (1 to 5) must be sent to the Chairman, JEE of the zonal IIT by Speed-post so as to reach by 17.00 hours on 17th June 2010.

1) Completed application form for admission with your recent photograph pasted on it.
2) Duly signed 'Undertaking' (if applicable).
3) Completed printed copy of choice sheet.
4) Medical examination report.
5) Demand draft of Rs. 1000/- drawn in favour the Chairman JEE of the zonal IIT (details as mentioned in Counselling Letter). Write your Name, Registration number, AIR/Category Rank on the backside of the DD. This counselling fee is non-refundable.

The forms mentioned in items 1, 2 and 4 can be downloaded from the counselling website for which links are provided in all the JEE websites.

If a candidate is unable to fill his/her on-line choice sheet and thus not in a position to send the printed copy to the counselling institute, he/she can avail on-line form filling facility at the counselling institute. This facility will only be available from 10:00 AM to 4:00 PM during June 9 – 12, 2010.

1.3.2 Candidates Belonging to OBC(NCL)/SC/ST/PD/DS Categories

Candidates belonging to these categories/ sub-categories will have to come in person to the IIT or IT-BHU or ISM Dhanbad as per the option exercised by them in their original application for JEE-2010. However, PD candidates will be counselled in a designated IIT mentioned in the Counselling Letter. In case a candidate is unable to attend for medical reasons, he/she can authorize in writing, his/her parent/guardian to attend the counselling session. However, the parent/guardian must produce a medical certificate to this effect as evidence. All candidates must bring the following documents:

1) Counselling Letter.
2) JEE-2010 Admit Card.
3) The original and two photocopies of the OBC(NCL)/SC/ST/DS category certificate as per the format given in the JEE-2010 Information Brochure (Also downloadable from the Counselling Website).
4) Completed application form for admission with your recent photograph pasted on it.
5) Duly signed 'Undertaking'.
6) Completed printed copy of choice sheet.
7) Medical examination report.
8) Demand draft of Rs. 1,000/- drawn in favour of the Chairman JEE of the counseling Institute (details as mentioned in Counselling Letter). Write your Name, Registration number, AIR/Category Rank on the backside of the DD. This counselling fee is non-refundable.

The forms mentioned in items 3, 4, 5 and 7 can be downloaded from the counselling website for which links are provided in all the JEE websites.

The main purpose of asking the candidates to appear in person is the verification of the category certificates. Failing to produce the authentic category certificate will make the candidate ineligible for admission under the desired category.

If a candidate is unable to fill his/her on-line choice sheet and thus not in a position to bring the printed copy to the counselling institute, he/she can avail on-line form filling facility at the counselling institute. This facility will only be available from 10:00 AM to 4:00 PM during June 9 – 12, 2010.

Candidates belonging to the SC, ST and PD categories will be paid second class/sleeper class return railway fare from the place of their normal residence to the place of counselling on production of a photocopy of valid travel document.

Candidates who qualify in PD subcategory will have to appear before a special Medical Board at **one of the following IITs: IIT Bombay, IIT Delhi, IIT Guwahati or IIT Madras.**

Two seats are available for preferential allotment in each institute for children of defence/ paramilitary personnel killed or permanently disabled in action during war or peace time operations (DS Category). Candidates belonging to DS category must bring the original certificate issued by the competent authority in the Directorate of Resettlement and Rehabilitation, New Delhi under the Ministry of Defence or Ministry of Home affairs, Government of India.

1.4 SEAT ALLOTMENT

1.4.1 First Allotment

First allotment of seats will be declared on JEE websites of all IITs on 28th June 2010. These candidates will have to pay a Registration Fee of Rs.40,000/- (Rs. 20,000/- for SC/ST/ PD candidates) to confirm the seat allotted to him/her. This amount will have to be paid through a Demand Draft favouring "The Registrar" of the institute to which he/she has been allotted a seat and can be submitted as soon as possible in person by visiting **any of the following IITs:** Bhubaneswar, Bombay, Delhi, Guwahati, Hyderabad, Kanpur, Kharagpur, Madras, Patna, Rajasthan, Roorkee, IT-BHU Varanasi or ISM Dhanbad and obtaining an official receipt. This payment must be made before 16.00 hours on 12th July 2010. This amount will be adjusted towards the fee to be paid at the time of admission.

While submitting this fee the candidate will be asked to exercise an option for the second allotment. He/she can opt for any one of the following:

Option 1: I do not want to participate in the second allotment as I am satisfied with the course allotted to me in the first allotment itself;

Option 2: I may be considered for allotment to any other course in my choice sheet in order of priority only at the same institute where I have got my first allotment;

Option 3: I may be considered for any course in my choice sheet in order of priority across any of the institutes.

1.4.2 Second Allotment

A second allotment will be made and published in the JEE websites of all IITs on 16th July, 2010. The following candidates will not be considered for second allotment:

- All the candidates who have not paid the Registration fee after the first allotment within the stipulated period (on or before 16.00 hrs, July 12th, 2010).
- Candidates having accepted the seats by exercising **Option 1**.

After the second allotment all candidates must report to the institute to which they have been allotted seat on the date of registration (refer the backside cover of this brochure) so as to complete the registration formalities including payment of fees.

1.4.3 Allotment of Seats to PD Candidates

Allotment of seats to selected candidates with Physical Disabilities (subcategory PD) belonging to different categories, i.e., GE, OBC(NCL), SC and ST, will be made category-wise in JEE-2010. Up to 3% of the total seats available to each category in each of the institutes will be made available to the PD candidates. These seats will be allotted to PD candidates according to their categories, ranks in the category-wise PD merit list and the choice sheet of courses submitted. Since the allotment of at least one seat in every course in every institute to PD candidates will lead to more than 3% reservation, these PD seats will be allotted to different categories over the years on a roster basis.

This year, the seats available to PD candidates be-longing to different categories are given in **Table-1**.

1.4.4 Counselling for Preparatory Course

All the fifteen IITs, IT-BHU and ISM are running preparatory courses for SC, ST and PD candidates for one year duration. After successful completion of this course these candidates will be eligible for admission to appropriate courses in the institute where they are undergoing the course in the next academic year (2011-12) against the vacancies of 2010.

1.5 PHYSICAL FITNESS AND MEDICAL EXAMINATION

Each candidate must bring a Medical Examination Report from a registered medical practitioner, in the prescribed format, which can be downloaded from the Counselling website. Candidates will be admitted only if they are physically fit for pursuing a course of study at the participating institutes.

In the case of PD candidates, the degree of physical handicap, as well as their fitness to undergo the course of study in which admission is sought will be certified by a duly constituted Special Medical Board. The PD candidates must report for

counselling on the day as mentioned in the counselling letter and appear before the Medical Board at any one of the following institutes: IIT Bombay, IIT Delhi, IIT Guwahati and IIT Madras.

Courses in Mining Engineering and Mining Machinery Engineering and related courses (Courses 28, 29 and 109, 110 and 111 **Section 3**) have additional prescribed standards of fitness. These candidates should be free from colour blindness and the standard of visual acuity with or without glasses should be as per DGMS Circular 14 of 1972 (the distant vision of eye with or without glasses should be not less than 6/6 for better eye and 6/9 for worse eye). The candidates with one-eyed vision are not eligible for these courses. In addition, candidates seeking admission in Petroleum Engineering related Courses and M Sc Tech Applied Geology (Courses 32, 50, 115) should be free from color blindness.

Candidates must make sure that they meet these standards if they opt for these courses. Responsibility for ensuring this is entirely the candidate's. In case a candidate does not meet these requirements but opts for these courses and is allotted one of them, his/her admission will be cancelled later on. In all such cases the candidate will have no claim for any other course of study in any of the institutes.

1.6 SPECIAL REQUIREMENTS FOR CERTAIN COURSES

ISM Dhanbad does not admit women candidates in the Mining Engineering, Mining Machinery Engineering and related courses (Courses 28, 29, 109 and 110 in **Section 3**). Women candidates are eligible to opt for Mining Engineering at IIT Kharagpur and IT-BHU (Courses 32, 50, 111 and 115 in **Section 3**), provided they fulfill the special medical requirements mentioned in **Section 1.5**. Women candidates opting for these courses may also note that Section 46(1) of the Mines Act, 1952 states that "No women shall, notwithstanding anything contained in any other law, be employed (a) in any part of a mine which is below ground, (b) in any mine above ground except between the hours 6 a.m. and 7 p.m.".

B.Des. and B.Arch.: Candidates desirous of joining these courses (Courses 37 and 38 in **Section 3**) will be required to qualify in **Architecture/Design Aptitude Test.** The test will be held on **Thursday, June 10, 2010** at all institutes where counselling is done**.** The test will be of three hours duration, from 10.00 am to 1.00 pm. Such candidates must have their JEE-2010 Admit Card with them to appear in the Aptitude Test. Candidates who fail to qualify in this Aptitude Test will not be eligible for admission to B.Des. or B.Arch. courses. Syllabus for the test is given in **Section 4.2**.

Candidates desirous of appearing for this Aptitude test must register by sending a request letter/email/fax to the Chairman JEE of the institute where he/she wants to appear for the examination. This request letter must reach the JEE office on or before June 9th 2010.

A candidate must ensure that he/she fulfills all the requirements for the courses opted for in his/her choice sheet.

1.7 SCHOLARSHIPS

Merit-cum-means scholarships of the Government of India are available at all Institutes. Apart from these, many other scholarships are available at various institutes. Candidates may contact the respective institutes for details.

1.8 COURSES AND AVAILABILITY OF SEATS

Brief profiles of the participating institutes are given in **Section 2**. The descriptions of the courses available in the different institutes are given in **Section 3**. In **Section 4, Table-1** gives the unique codes for various courses to be filled in the Choice Sheet. For example, the course code for Aerospace Engineering at IIT Bombay is B001. In the line below the code of each course, the numbers of seats available in that course for the categories GE, OBC, SC, ST, respectively, are given. The line at the bottom gives the availability of PD seats. **Table-2** provides the opening and closing All India Ranks of the *previous year* for various courses. These ranks are given only to give an idea as to how the course allotment had taken place last year. This data does not give any guarantee that for a given AIR, the course which was available last year will also be available this year. So this has to be treated only as an indicator.

2. PARTICIPATING INSTITUTES

2.1 INDIAN INSTITUTE OF TECHNOLOGY BHUBANESWAR

Indian Institute of Technology Bhubaneswar (IIT-BBS) is one of the eight new IITs set up by the Government of India in 2008-09. In the first year, the Institute functioned from the premises of its mentor institute IIT Kharagpur. The journey at Bhubaneswar began on 22 July 2008 from the IIT Kharagpur Extension Centre at Samantapuri, Bhubaneswar with around 240 students in Civil, Electrical and Mechanical Engineering. For the academic session 2010-2011, the admission of students will take place in Civil, Electrical and Mechanical Engineering disciplines with an intake of 40 students in each discipline.

IIT-BBS is aiming to imbibe the culture of individual distinction amidst community partnership. It is also spearheading a borderless research environment, where young minds are enthused into "discovery science", and "solution science". The rich natural resources in the state of Odisha and the vast coast-line offers ample opportunity to IIT-BBS fraternity in launching specialized UG/PG programs which are locally relevant as well as globally responsive.

Campus & Facilities

IIT Bhubaneswar is presently operating from the following locations in the city of Bhubaneswar: IIT-Kgp extension centre at Samantapuri, Toshali Plaza at Satyanagar, Govt. Colony at Gajapati Nagar and Kesura Residential Complex. The academic campus is Wi-Fi enabled and equipped with class rooms having audio-visual aids, laboratories, library, high bandwidth internet and video conferencing facility. The library is in the stage of automation.

The permanent campus of IIT Bhubaneswar will be located on a 936 acre land in a picturesque surrounding at Argul, which is about 25 Km from Bhubaneswar City Center and 14 Km from Biju Patnaik Airport. The Architect-cum-Project Management Consultant has already been appointed and it is expected that in next 2-3 years this campus will start functioning.

Hostel Accommodation

Accommodation with mess and other facilities are available for both girls and boys at the residential campus. The hostels have 24x7 internet facility, hall-library, gymnasium, common room, and other recreational facilities. Medical facility is provided to students both in the campus and in the hostels. A counselling cell with a psychologist-cum-counselor and student guides also assist the students.

Academic Programmes

The Institute is presently offering the following academic programmes:

- 4 year B. Tech Degree programme
- Ph. D. Programme

The 4-year B. Tech. programme is offered in Civil, Electrical and Mechanical Engineering disciplines with an intake of 40 in each. The credit based curriculum is spread over 8-semesters and includes summer internship, as well as research projects. For evaluation in a subject, the Institute follows a seven-point grading system with letter grades and the corresponding grade points per credit. The Cumulative Grade Point Average (CGPA) is computed at the end of each semester. The CGPA secured by a student reflects his/her performance upto and including that semester.

The Ph.D. programme has started from the academic session 2009-10 in the five Schools (Basic Sciences, Humanities-Social Science & Management, Electrical Sciences, Mechanical Sciences, and Infrastructure).

Rules for Change of Branch

A student admitted to a particular branch of the B.Tech. Course will normally continue studying in that branch till completion. However the Institute may permit a limited number of students to change from one branch to another based on CGPA criteria and sanctioned strength in a school after the completion of first two semesters.

Financial Assistance/Scholarships

Merit-cum-Means scholarship and other financial assistance are available to the students.

How to Reach Us

The Samantapuri Campus is about 8 km from Bhubaneswar Railway Station and 12 km from Biju Patnaik Airport. The Toshali Plaza campus is about 1 km from Bhubaneswar Railway Station and 5 km from Biju Patnaik Airport. Private/ Pre-paid taxi can be hired to reach the Institute.

Important Contacts

For further information, please contact:

Information Cell :	Phone:	+91-674-2306-300
		+91-674-2301-337
Academic Section :	Phone:	+91-674-2301-342
Registrar's Office :	Phone	+91-674-2306220/211
	Fax:	+91-674-2301-983
	E-mail:	registrar@iitbbs.ac.in
	Web:	www.iitbbs.ac.in

2.2 INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

IIT Bombay was established in 1958, with the cooperation and participation of the then Government of USSR under UNESCO's technical assistance programme, and celebrated its Golden Jubilee in the year 2008-09. It is reputed for the quality of its faculty and the outstanding caliber of the students graduating from its undergraduate and postgraduate programmes. Today the Institute is recognized as a centre of academic and research excellence offering engineering, science, management and humanities education on a par with the best in the world.

Located at Powai, in the metropolitan city of Mumbai, the industrial and economic capital of India, the IIT campus extends over 500 acres of verdant land, nestled between hills and flanked by Powai and Vihar lakes. The campus is located on the north-east part of Mumbai, about 30 km from the main railway stations and about 15 km from the airports.

The Institute offers a large number of undergraduate and postgraduate programmes in engineering, science, management and humanities. It has a total of thirteen academic departments, two schools, four centres and three interdisciplinary programmes which together constitute the academic fabric of the Institute.

The institute has well-equipped laboratories and workshops, and also excellent computer facilities in all the departments in addition to a central Computer Centre. It also houses one of the finest technical libraries in the country. About 2345 students are on roll in the undergraduate programmes and 3520 in the postgraduate (including Doctoral) programmes. This includes a number of foreign students. The faculty strength is about 460.

IIT Bombay follows a semester system. An academic year (July-April) consists of two semesters, each of approximately 16 weeks duration. The first semester begins in the last week of July and ends by the last week of November. The second semester starts in the first week of January and ends by the last week of April. In each of the two semesters of the first year, a student is required to register for all the courses listed in the curriculum for that semester. Students belonging to the SC/ST category and students who are identified as academically weak at the end of the first semester may be prescribed a specially worked-out Reduced Load Programme (RLP). Such students may be required to undergo special courses in case they are found to have inadequate background.

The Institute follows a credit system. Credits are allotted to various courses depending on the number of lectures, tutorials and laboratory hours per week. The student's performance in a course is continuously evaluated throughout the semester and culminates in the award of Grade on a 10-point scale. Performance in a semester is evaluated in terms of the weighted average of grade points secured in all the courses registered in that semester, which is known as Semester Performance Index (SPI). A Cumulative Performance Index (CPI) is the weighted average of the grade points obtained in all the courses registered by the student since they entered the Institute. The teaching programmes are characterized by their flexibility and informality. The strong faculty-student interaction on the residential campus provides opportunity to students to work on seminars, publication and projects sponsored by the industry and national agencies.

To students admitted through JEE-2010, IIT Bombay offers the following undergraduate and postgraduate programmes:

- B.Tech
- B.Tech. (Honours) or B.Tech. With 1minor,
- B.Tech. (Honours) with 1 Minor or B.Tech. With 2 Minors
- Dual Degree M.Tech.Integrated M.Sc.

The B.Tech. programme consists of eight semesters spread over four years, and the Dual Degree M.Tech. and Integrated M.Sc. programmes consist of 10 semesters spread over five years. In the Dual Degree M.Tech. programme, a B.Tech. degree of the parent department and an M.Tech. degree of a specialization within the parent department is given at the end of fifth year. In the undergraduate programmes, a "Minor" is awarded to a student for completing, in addition to the minimum requirement of 250 credits, a prescribed set of courses from departments other than that in which the student is enrolled for his basic B.Tech. programme. Similarly, "Honours" is awarded to students completing a prescribed set of courses and/or project in their own departments. This structure of academic programmes provides flexibility to suit the varied interests of students and helps build multifarious competencies that employers demand besides satisfying the widely varying attitudes, abilities and aspirations of students.

The Institute continues to introduce new areas in its academic programme and innovation in its academic activities. The Shailesh J. Mehta School of Manage-ment, the School of Biosciences & Bioengineering and the Department of Energy Science & Engineering are recent initiatives. Student exchange programmes initiated with Universities in Germany, France, USA, and Japan have taken off successfully. Students are encouraged and supported to submit research papers and participate in national and international conferences.

IIT Bombay is a residential campus that has all the students and most of the faculty and staff living on campus. The Institute has 13 students' hostels, which include the recently added two state-of-the-art hostels each having accommodation facilities for about 450 students and two well-secured hostels for women students. Each hostel has modern amenities including a computer room, gym, LAN connection to each room. Students, however, are not permitted to operate and maintain motorized vehicles of any type in the campus

except on medical grounds. The Institute also has a good 52-bed hospital with facilities OPD and in-patient facilities that include a pathology lab, dental care, radiology, sonography, physiotherapy, and an operation theatre.

The Student Activity Centre (SAC) provides excellent facilities for sports and cultural activities. Sports facilities include a swimming pool, tennis, badminton and squash courts and vast playgrounds for field games. Wildlife camps and trekking are popular off campus activities. Cultural activities on the campus are fostered by film clubs, classical music societies, debating and drama clubs and a hobbies club. The Institute also has strong NSS/NSO programmes. The Entrepreneurship Cell guides students and promotes in them the spirit of entrepreneurship by organizing competitions, and lectures and workshops by eminent entrepreneurs. A business incubator also provides opportunities to students to develop products and technologies, and to generate their own business ventures. The Cell for Human Values – a unique feature of IIT Bombay, enriches the minds of students through its various activities.

A Faculty Advisor is specially appointed to look after the academic performance and matters related to SC/ST students. A Foreign Students' Advisor helps and guides the students from abroad in academic and non-academic matters.

Rules for Change of Branch

Students are eligible to apply for change of Branch/ Programme after completing the first two semesters. Only those students who complete the prescribed course credits without backlog during the first two semesters of 4-year B.Tech./5-year M.Sc./Dual Degree programmes and have secured a Cumulative Performance Index (CPI) of 6.5 or more shall be eligible to apply for change of Branch/ Programme. The following rules/guidelines will be used for considering applications for change:

1. Top 1% of total number of students admitted in the year will be permitted to change branch without any constraints.
2. For others, change will be permitted strictly on merit basis. Students without fail grades and backlogs, and with CPI > 6.5 will be eligible to apply and can give their choices.
3. The request for change (in the order of merit) for a student S1 from branch A to branch B will be considered if the
   (a) Strength of branch B does not exceed the sanctioned strength
   (b) Number of students on roll in branch A does not fall below 85%.

   (The request of S1 will be reconsidered – again in the order of merit – if S1 does not violate (b) above due to another student getting transferred to branch A.)
4. If student S1 is not permitted to change from branch A to B (due to (b) above), any other student S2 with CPI less than S1 will also not be permitted to change to branch B.
5. The request for change of branch from a student belonging to SC/ST category may be considered as special cases by the Chairman, Senate, on merit.
6. All branch transfers can be effected only once at the beginning of the second academic year. No application for change of branch during the subsequent academic years will be entertained.
7. Students will be permitted to change from B.Tech. to Dual Degree Programme in the same department at the end of third and fourth semesters subject to the department's recommendation.

2.3 INDIAN INSTITUTE OF TECHNOLOGY DELHI

Established as a College of Engineering in 1961, this Institute was declared as Institution of National Importance under the "Institutes of Technology (Amendment) Act 1963" and was renamed as "Indian Institute of Technology Delhi". It was then accorded the status of a university with powers to decide its own academic policies, to conduct its examinations, and to award its degrees.

IIT Delhi is situated at Hauz Khas in South Delhi, bounded by Sri Aurobindo Marg on the east, Jawaharlal Nehru University complex on the west, National Council of Educational Research and Training on the south, and the Outer Ring Road on the north. The Institute campus is about 20 km from Indira Gandhi International Airport, 10 km from domestic terminal of the airport, 19 km from Delhi main Railway Station and 14 km from New Delhi Railway Station.

The Institute campus extends over an area of 320 acres with many topographical features, imaginatively laid out with picturesque landscape. With clean and wide roads, the campus presents a spectacle of harmony in architectural and natural beauty. Most of the students, faculty and staff reside on the campus. The main academic building houses various teaching and research facilities. Although each department is a separate entity, all the departments together constitute an integrated complex.

Each academic year consists of two semesters and a summer term. The education system is organized around a credit system, which ensures continuous evaluation of a student's performance and provides flexibility to choose courses so as to facilitate progress at an optimum pace suited to one's ability or convenience. Each course is assigned certain number of credits depending upon the class contact hours. A minimum number of credits are to be completed in order to qualify for the award of degree. IIT Delhi has revised its curriculum with effect from academic session 2003-2004. The revised curriculum emphasizes on self-learning, project activity and laboratory work. It leaves sufficient time for students to take part in other activities like sports and recreation, and encourages them to be creative and innovative.

The Students Activity Centre provides a number of facilities for students' extracurricular and physical development. The central two-storied 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 amphitheatre constructed in modern style is an added amenity to the Centre. The campus also provides such amenities as staff club, hospital, shopping centre, bank, post office, community centre, stadium and playing fields.

Credit System

The prominent features of the credit system are: the process of continuous evaluation of a student's performance, the absence of pass or fail on annual basis and the flexibility to allow a student to progress at the pace suited to his/her individual ability and convenience subject to the regulations of the credit requirements.

Each course, except for a few special courses, has a certain number of credits assigned to it depending on its lecture, tutorial and laboratory contact hours in a week. Each course is coordinated by a member of the faculty called the course coordinator. He/she has the full responsibility for coordinating the course, coordinating the work of other members of the faculty involved in the course, holding tests and awarding grades. In case of any difficulty, students are expected to approach the course coordinator for advice and clarification.

A letter grade with a specified number of grade points is awarded in each course for which a student is registered. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average maintained by him/her. A minimum number of credits and a minimum cumulative grade point average (CGPA) are necessary in order to qualify for a degree.

Rules for Change of Branch

A student is eligible to apply for change of branch at the end of the first year only, provided he/she satisfies the following criteria.

- CGPA for General category students > 7.50
- CGPA for SC/ST and Person with Disability category students > 6.50
- Earned credits at the end of the first academic session > 40

Change of the branch will be permitted strictly in the order of merit as determined by CGPA at the end of the first year, subject to the limitation that the actual number of students in the third semester in the discipline to which transfer is to be made should not exceed the sanctioned strength, and the strength of the discipline from which transfer is being sought does not fall below 90% of the existing strength.

For a student with CGPA = 9.0, even if a vacancy does not exist, he/she will be permitted to change discipline provided the strength in the discipline to which the change is being sought does not exceed by 5% of the sanctioned strength. Also, in such cases, he/she will be permitted to change discipline even if the strength of the discipline from which change is being sought falls below 90% of the existing strength.

Stipulation of minimum credits and CGPA requirements will not be insisted upon for change of discipline to a branch in which a vacancy exists and the concerned student was eligible for admission to that discipline at the time of entry to IIT Delhi. However, requirements of credits and CGPA will continue to apply in case of both General and SC/ST category students seeking change to a discipline to which the concerned student was not eligible for admission at the time of entry to IIT Delhi.

Change from a 4-year B.Tech. programme to a dual degree programme

A student registered for a 4-year degree programme in a Department can be permitted to change his/her registration from the 4-year to a 5-year programme of the same department provided the B.Tech. part of the dual degree programme into which the student is desirous of registering is the same as the programme for which the student was admitted through JEE subject to fulfilling the following criteria:

(a) The student must have completed at least 120 credits by the end of sixth semester and secured a minimum CGPA of 7.5.

(b) The maximum number of students that can be permitted such a change will be limited to 10 % of sanctioned strength of the intake into the relevant 4-year programme of the department.

Change from any 4-year B.Tech. programme into a PG (M.Tech.) programme with advanced standing

A student registered for a 4-year B.Tech. degree programme can earn an additional M.Tech. degree by opting for a change in his/her registration to that with advanced standing. The option is to be exercised towards the end of the sixth semester. Advanced standing request will be considered only if the student has a CGPA of at least 7.5 at the end of the sixth semester. In the advanced standing scheme, the student can earn an M.Tech. degree in addition to his/her B.Tech. degree by spending an additional year. M.Tech. programmes for which the student will be eligible and other details will be provided later.

Subject to the above conditions, change over from one to the other undergraduate programme (viz., B.Tech., 5-year M.Tech. Integrated and 5-year M.Tech. Dual Degree) is permissible.

2.4 INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR

Indian Institute of Technology, Gandhinagar (IITGN) is one of the IIT's in the country, established in the year 2008 with the objective of enhancing the facilities for higher education, research and training in various fields of Science and Technology.

IITGN strives to create and nurture a vibrant community dedicated to the generation and dissemination of knowledge that combines cutting edge innovation with a commitment to fostering a just and humane world. Our mission is to build an institute dedicated to achieving the highest standards of education through globally recognized research activities as well as teaching practices that create future leaders through the best development of our students' intellectual and human potential. We aim to cultivate an open and exciting learning environment that thrives on local and global interactions, making IITGn a centre of excellence that actively contributes to the betterment of the social milieu within which it is situated.

Currently three disciplines viz. Chemical Engineering, Electrical Engineering and Mechanical Engineering have been started. These academic programmes have received enthusiastic responses from the last two batches of entrants and the Institute is progressing well towards its set objectives. Gujarat state is known for its excellent infrastructure with thriving industries, prestigious academic and research institutes and an ambiance which encourages entrepreneurship. Therefore, IITGN seems to have everything going for its progress towards a bright future.

Location

IITGN is temporarily located at the Vishwakarma Government Engineering College (VGEC), at Chandkheda, on Visat – Koba - Gandhinagar Highway, approximately 10 km from Sardar Vallabhbhai Patel International Airport and 14 km from Ahmadabad Railway Station. Public transport facilities are readily available to reach Chandkheda from both the airport and the railway station.

Academic Programmes

The Institute presently offers the following academic programmes

- 4 year B.Tech. Degree programme (CL,EE,ME)
- Ph.D. Programme.

IITGN follows a specialized semester based academic system. There are two semesters in an academic year (*Autumn – July*-Nov; and *Spring – January-April*). Students are required to follow the laid down procedures and meet the academic requirements of each semester to progress in their respective programme of study. The academic programmes of the Institute are governed by Rules and Regulations approved by the Senate which is the supreme body that governs all academic matters. The Senate continuously monitors the academic programmes and makes appropriate modifications and improvements as and when required. It also finalizes the academic calendar every year for various academic activities.

In general a certain quantum of academic work, measured in terms of credits, is laid down as the requirement for a particular degree. A student earns credits by satisfactorily passing courses and engaging in other academic activities every semester, as specified by the individual department. The Courses of Study bulletin lists the course work as per the following conventions. The credit associated with a course is a number which depends upon the number of hours of instruction per week in that course. Similarly the credit associated with any of the other activities is dependent upon the quantum of work expected to be put in for that activity per week. Courses are broadly classified as *Theory courses* and *Laboratory Courses.* Theory courses consist of lecture (**L**) and tutorial (**T**) hours, but may have attached practical (**P**) hours in special cases. Laboratory courses consist of practical hours, but may have attached tutorial hours in special cases. Credit (**C**) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of two (**2**) for lecture and tutorial hours, and a multiplier of one (**1**) for laboratory hours. Thus, for example, a theory course having two lectures and one tutorial per week throughout the semester carries a credit of 6. Similarly, a laboratory course having one tutorial and three laboratory hours per week throughout semester carries a credit of 5. Academic activities such as Seminar and Project carry their specially assigned credits depending on the quantum of expected work. There are other academic activities such as Practical Training (PT), Works Visit and NSO/NSS/NCC, which are non-credit but mandatory requirements which must be fulfilled for successful completion of the programme of study.

IITGN is developing its own new B.Tech. curriculum, retaining the core components and values of IIT education and incorporating new features in line with the demands of knowledge driven global economics.

Facilities

IITGN is temporarily housed at VGEC, Chandkheda, and Gandhinagar. The academic infrastructure such as classrooms, laboratories, faculty offices, library, medical facilities, etc. have been created and established exclusively for the use of IITGN students and faculty. The Iinstitute is commissioning state of the art dedicated facilities for technical arts components such as workshop practice, engineering drawing etc. at the temporary location. Dedicated facilities such as mess, playground and medical clinic are available to the students on the VGEC premises.

Students' hostel has recently been constructed within the premises of the VGEC.

Government scholarship (Merit-Cum-Means) is awarded to the students as per Government of India rules. Efforts are being made to institute private scholarships and a few private scholarships are already in place.

The Institute is proud of its record of arranging internship opportunities [in India and overseas] for a substantial number of its undergraduates.

Land for the Institute's permanent campus has already been identified in the periphery of Gandhinagar and construction work is expected to commence soon.

Rules for Change of Branch

After successful completion of the first two semesters, students are eligible for change of branch, subject to the fulfillment of the laid down conditions. Rules / guidelines governing the change of branch are:

1. Any student with CPI greater than or equal to 9.50 will be allowed a Change of Branch without restriction.

2. For others, change will be permitted in the order of their merit determined by their respective CPI. Only those students with CPI greater than or equal to 6.50 and without any fail grade / backlogs will be eligible to apply.

3. The request for change (in the order of merit) for student S1 from branch A to branch B will be considered if -

   (a) Strength of branch B does not exceed by more than 10% over the sanctioned strength for that branch.

   (b) Number of students on rolls in the branch A does not fall below 50% of the sanctioned strength.

   (c) The request of S1 will be re-considered (*again in the order of merit*) due to another student getting transfer to branch A, provided this re-consideration does not violate (b) above.

4. All such transfers can be effected only once at the beginning of the second academic year.

IIT Gandhinagar is a very student-oriented institution, and our endeavor would always be to ensure that the students get the best of everything that is needed to create outstanding scientists and engineers.

Prospective students are strongly urged to access the Institute web site: http//:www.iitgn.ac.in.

2.5 INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

IIT Guwahati was established in 1994 and the first batch of students was admitted in July 1995. The residential campus is spread over 700 acres of land on the north bank of the river Brahmaputra with a picturesque surrounding. The campus was planned taking full advantage of the natural features of the terrain, which consists of several hillocks and lakes. The Brahmaputra flows majestically on one side, while the other sides have backdrops of blue hills. The campus is about 20 km from Guwahati railway station and about 15 km from Guwahati airport. To reach the institute from the city, there is the institute bus service that runs regularly to and from the city. This bus service starts from near the railway station. Taxis are also available at the railway station. Pre-paid taxis are available at the airport to get to IIT Guwahati.

With a cool and pleasant weather for most of the year, the city has an annual rainfall of about 1000 mm. A high humidity (80 to 95%) is common in the monsoon season. The maximum day temperature in summer is around 35^0C and the minimum temperature in winter is around 7^0C. Guwahati, the gateway to the north eastern region of India, is well connected by rail and by air to the rest of India. Direct train services are available from/to all major cities in the country. All major domestic airlines operate regular flights from/to New Delhi, Mumbai, Kolkata, Bangalore and Hyderabad with connectivity to all major cities in the country.

Academic Programmes

Undergraduate programmes offered include **B.Tech**. in ten disciplines, viz. Biotechnology, Chemical Engineering, Chemical Science & Technology, Civil Engineering, Computer Science & Engineering, Electronics & Communication Engineering, Electronics & Electrical Engineering, Engineering Physics, Mathematics & Computing, and Mechanical Engineering; and **B.Des**. in Design. Postgraduate programmes offered are, two-year M.Sc. in Physics, Chemistry, and Mathematics & Computing, a two-year M.A. in Development Studies, M.Tech. in all Engineering disciplines, M.Des., and Ph.D. in all disciplines.

Facilities Unique to the Institute

State-of-the-art teaching laboratories established in all the engineering and science disciplines, combined with a Central Workshop and Computer Centre, provide value and strength to the programmes. The Computer Centre with its modern facilities and pleasant atmosphere is a favourite place of the students for cracking software problems or surfing the Internet. The Central Library has an excellent collection of books, current periodicals, back volumes of journals and databases on compact discs. The Central Library has a computerized access facility through its network server. Students can browse books and journals online. In addition to departmental facilities, the Central Instruments Facility (CIF) of the Institute-with provisions of several state-of-the-art equipment, also support students in carrying out their projects and other research work. Besides, to tap the ideas of innovative students and to translate such ideas into commercially significant products, the Institute has a Technology Incubation Centre (TIC). TIC's objective is to extend support to innovators in the form of finance, space and technical guidance.

Boarding and Lodging

There are seven boys' hostels and a girls' hostel for accommodation of the students. Two more hostels are under construction. Each hostel has a mess, a canteen, a juice shop, a stationary shop, indoor games facilities, cable TV, local area network (LAN) connection, and uninterrupted water and power supplies. All students enjoy the privacy of a single room.

An academic complex, a married scholars' hostel, a guest house with a capacity of 144, an administrative building, lecture theatres, a state-of-the-art auditorium and ample residential quarters are there on campus. These cater to the requirements of classrooms, laboratories and residences for faculty and staff. Branches of Canara Bank and State Bank of India with ATMs, a post office, a computerised railway Passenger Reservation System (PRS) facility, a book shop, a shopping complex and several PCOs serve the needs of campus residents. The Institute has stadiums for football, cricket, hockey and track & field events, and courts for tennis, volley ball and basket ball. It also has a gymnasium, an indoor sports complex, and a swimming pool. The IIT campus offers plenty of scope for trekking and climbing, so that one can enjoy a challenging and stimulating academic environment blended with a rich outdoor life.

Health Care

The Institute gives great importance to health care. With three regular Medical Officers, supported by a number of outsourced doctors (including specialists), the Institute's medical team has been providing efficient services to all its staff, students and faculty members. The Institute's seventeen-bed hospital has trained nurses on duty round-the–clock. It has modern diagnostic equipment, a pathological laboratory, a pharmacy, and two ambulances. For indoor patients, the Institute also has arrangements with top medical institutions of Guwahati, such as Guwahati Neurological Research Centre (GNRC), International Hospital, Down Town Hospital, Guwahati Medical College Hospital, etc.

Besides, to keep the students mentally and physically healthy, during the first two years of the undergraduate programme, the Institute offers Physical Training (two hours per week) as non-credit but compulsory courses.

Financial Assistance/Scholarships

The Institute offers a number of scholarships to the students, viz, Merit-cum-Means Scholarship is awarded to a maximum of 25% of general category B.Tech./B.Des. and M.Sc. students, and Institute Merit Scholarship is awarded to those undergraduate students of second, third and fourth years, who score the highest Yearly Performance Index (YPI) in every branch.

Besides, Govt. of India SC and ST scholarships, State Govt. scholarships and various industry sponsored scholarships are also available to the deserving students.

Training and Placement

The 12th batch of B.Tech. and 9th batch of B.Des. students are graduating this year. The graduates of the previous batches have been recruited in reputed private and public sector organizations through campus interviews. A large number of B.Tech. and B.Des. graduates have obtained admission to M.S. and Ph.D. programmes in universities abroad with scholarships.

Credit System

The Institute follows the semester-based credit system. The B.Tech. and B.Des. programmes consist of 8 semesters spread over 4 academic years. A student takes 5 to 6 theory courses in addition to laboratory courses in each semester. A project in the final year provides the student ample scope for independent work. Credits are allotted to various courses depending on the number of lecture/tutorial/laboratory hours per week. A student's performance in a course is continuously evaluated throughout the semester and culminates in the award of a grade on a 10-point scale. Performance in a semester is evaluated in terms of the weighted average of grade points secured in all the courses registered in that semester, known as the Semester Performance Index (SPI). A Cumulative Performance Index (CPI) is given, representing the weighted average of grade points secured by a student in all the semesters.

Rules for Change of Branch

The Institute may permit a limited number of students to change from one branch of study to another after the end of the second semester, subject to certain conditions, some of which are given below:

1. Only those students will be eligible for a change of branch who have completed all the common credits required in the first two semesters of their studies in their first attempt with a CPI of not less than 8.00 and without having had to pass any course requirement in the summer term examination.
2. Change of branch is permitted strictly on the basis of merit (CPI at the end of two semesters) subject to the limitation that the strength of a branch does not fall below the existing strength by more than ten percent and does not go above the sanctioned strength by more than ten percent.
3. Change of branch is permitted from a B.Tech./B.Des. programme in any branch to a B.Tech./B.Des. programme in any other branch.

2.6 INDIAN INSTITUTE OF TECHNOLOGY HYDERABAD

Indian Institute of Technology Hyderabad (IITH) started in August 2008 with B.Tech. programs in Computer Science &

Engineering (CSE), Electrical Engineering (EE) and Mechanical Engineering (ME), each with 40 seats. The PhD programs in Engineering, Sciences and Humanities, commenced in January 2010. Additional post graduate and undergraduate degree programs will be introduced in a phased manner. Indian Institute of Technology Madras (IITM) is the "Mentor Institute" for IITH.

IITH is currently operational from a full-fledged residential campus inside the Ordnance Factory Medak (OFMK) premises in Yeddumailaram, which is about 45km from the center of Greater Hyderabad. Complete and modern academic facilities (classrooms, laboratories and workshops) have been created in this temporary campus, along with hostels including dining hall. Sports facilities and hobby research laboratory facilities have been created enabling the students participate in a diverse range of activities. The Government of Andhra Pradesh has given 212 hectares of land in Kandi District on NH 9 (about 12 km from the OFMK campus) for developing the permanent campus of IITH. The master planning, design and construction activities are underway on the new campus. It is expected that the new campus will be operational by December 2010.

For the academic year 2009-10, the curriculum, course structure and syllabi of various courses were adopted as per IIT Madras. From the academic year 2010-11 onwards, a comprehensive new curriculum (UG and PG) will be developed with the required customization for IITH. The fee structure of IITH will be similar to that of IIT Madras. For additional details, please visit the IITH website: www.iith.ac.in.

2.7 INDIAN INSTITUTE OF TECHNOLOGY INDORE

The Institute

Indian Institute of Technology Indore (IITI) is one of eight new IITs established in the country during 2008-09 as a part of the mega-project that envisages India as a Global Technology Leader. IIT Indore started functioning from July 2009. Continuing with the tradition of the older IITs, IIT Indore aims to play an active role in the task of propelling India on her growth-trajectory by focusing on education, research and development. IIT Bombay is the "Mentor Institute" for IIT Indore.

Indore City

Indore is the commercial capital of Madhya Pradesh with many industries in the area of mechanical engineering, pharmacy and electronics. It is an educational-hub and have institutes of international repute like Raja Ramanna Center for Advanced Technology (RRCAT), IUCA, and IIM Indore. Indore has young and vibrant students' population. The city is well connected by road, rail and air and is strategically located in close proximity to Mumbai, Delhi and Ahmedabad.

Academic Programmes

The institute offers a 4-year B. Tech. programme in (i) Computer Science and Engineering, (ii) Electrical Engineering and (iii) Mechanical Engineering, with an intake of 40 seats (20 for general category, 11 for OBC category, 6 for SC category, and 3 for ST category) in each branch. The institute has developed its own new academic curriculum to be implemented from 2010 batch onwards. More information related to academics can be found at http://www.iiti.ac.in. Admission to the PhD programmes in the disciplines of Computer science and engineering, Electrical engineering, Mechanical engineering, Chemistry, Mathematics, Physics, and Humanities & Social Sciences have started since Jan. 2010.

The Faculty

There are total 26 faculty members including 20 regular faculty members and remaining being adjunct faculty and faculty members on deputation from IIT Bombay. The faculty members of the institute have been selected on the basis of the same high standard criteria as being followed in the older IITs. All faculty members hold Ph.D. degrees from reputable national and international institutions and several have international post-doctoral research experience. The process to recruit more faculty members is under process.

Upcoming Campus

IIT Indore's permanent campus will be located at Simrol which is a small village in Mhow Tehsil in district of Indore. The site for IIT Indore is about 25 km from Indore city centre, connected to it by the state highway, Khandawa Road. The state government has provided over 500 acres of land for the institute's development. The pre-construction activities have begun, including soil-investigation, water-resistivity survey, etc. It is now planned that IIT Indore will have its infrastructure sufficiently ready so that the batch entering in 2012 will be housed in the new campus.

The Interim Site and Institute Facilities

Currently, IIT Indore is functioning from the premises of the Institute of Engineering and Technology (IET) of Devi Ahilya Vishwavidyalaya (DAVV) on Khandwa Road which is 4 km. from the city centre. IIT Indore has complete and modern academic facilities including one virtual classroom, modern teaching facilities in the classrooms, a modern computer centre, ever-expanding Central Library, well-equipped undergraduate Physics and Chemistry laboratories that were developed last year and probably are amongst the best of the undergraduate laboratories in the country. Other laboraroties include those for the second year courses of different engineering branches with modern and sophisticated equipments/instruments and for an institute core laboratory course on Experimental Engineering Methods. The institute

is also in the process of acquiring some state of the art research equipment to cater to the research interests and needs of the existing faculty members and also to attract best of the research scholars and faculty members as part of our endeavour for a world class research institute.

Library

The Central Library at IIT Indore is rapidly developing its collection of books, reference books, periodicals, and electronic resources. The text book collection in the library provides vital support for on-going undergraduate teaching programme. The books are on various disciplines ranging from Computer Science and Engineering, Mechanical Engineering, Electrical Engineering, Mathematics, Physics, Chemistry, Economics, and Philosophy. The library is also developing a fine collection of books on Literature and English Language. This section represents the Classics as well as contemporary literature. Users can find here reading material for extra-curricular and leisure time reading that is both enriching and absorbing – from books by Shakespeare, Dickens, and Jane Austen to Harry Potter, Lord of the Rings, and Sherlock Holmes. Indian authors such as Vikram Seth, Amitav Ghosh, Arundhati Roy, and Salman Rushdie enjoy pride of place here. This section has instantly become a centre of attraction among both student and faculty community. There is also a select collection of books on sports, biographies, and general interest titles. The magazines and newspaper section includes current interest titles like India Today and Reader's Digest; and also titles such as Auto India and Auto Car. The newspaper section includes all prominent local and national dailies. The Library is in the process of introducing various new services to users in addition to the Lending Facility and Reading Room Facility currently available. Introduction of Library Software to enables the entire library collection and services to be fully automated.

Medical Facilities

IIT Indore has an MOU with CHL Apollo Hospital to cater to the medical requirements of the students, faculty, staff, and their family members. Institute doctor is available in the hostel premises on regular basis and for medical emergencies a round-the-clock transport facility is also available at the hostel premises.

2.8 INDIAN INSTITUTE OF TECHNOLOGY KANPUR

History:

IIT Kanpur is reputed all over the world for its innovative academic programmes stressing science-based engineering education. Since its inception in 1960, the Institute is engaged in carrying out original research of significance and technology development at the cutting edge. It introduced for the first time in the country computer science in the undergraduate curriculum, semester-based flexible programmes, interdisciplinary programmes in several areas, and a broadband letter grading system. In its initial years, IIT Kanpur benefited from a novel experiment in international cooperation when a consortium of nine leading universities of the USA collaborated with it to launch world-class engineering education in our country.

Location and Accessibility*:*

It is located just outside the major industrial town of Kanpur which is well connected with all other metropolitan cities.

Academic Programmes:

IIT Kanpur imparts training to students so that they become competent and motivated engineers and scientists, and awards Bachelors, Masters and Doctoral degrees in various branches of technology and science. The Institute celebrates freedom of thought, cultivates vision, nurtures entrepreneurship and encourages growth, inculcating human values and concern for the environment and society at the same time.

The Institute follows the semester system with two eighteen-week semesters, including a one-week recess in each semester. In addition, an eight-week summer term is also offered to help students make up deficiencies in their course work. This enables students to reduce any delays in completing their programme due to illness or any other reason.

A diagnostic test to ascertain general proficiency in English is conducted for ALL students admitted to IIT Kanpur. Based on their performance in this test, some students are told to take a basic course in English Language.

A slow-paced programme is offered to help those who show deficiencies in Physics, Mathematics and/or English in the first mid-semester examination. Such students are advised to take slow-paced courses in any one, two or all of these subjects for easier assimilation of contents and concepts. In the slow-paced courses, the subject matter is covered in a period of two semesters instead of the normal one semester. It may be emphasized that the option to take the slow-paced courses is a privilege and gives the deficient student a chance for better performance. However, it may in some cases lead to delay in completion of the academic programme.

Facilities Unique to the Institute:

In keeping with its reputation for academic excellence, the Institute has state-of-the-art facilities with one of the best and openly accessible computing facilities and modern laboratories that include a unique flight laboratory with four powered aircrafts, four gliders and a one kilometer runway. The P K Kelkar Library of the Institute is one of the finest scientific and technological libraries with an online information retrieval system over the campus LAN. The curriculum at IIT Kanpur has a strong emphasis on Humanities and Social

Sciences (HSS). The HSS department offers courses in Psychology, Sociology, Economics, Philosophy, Fine Arts, English and Sanskrit Languages, among many other areas. A Language Laboratory with computer controlled audio and video components, offers courses in foreign languages like French and German.

About the students

The Institute has a strong counselling service to help students settle down comfortably in the new environment and cope with the stresses of student life. Sincere and dedicated student volunteers, helped by faculty advisers, organize the orientation programme for fresh entrants, provide extra help in course work if needed, conduct language classes, etc. The students are involved in all the decision making processes of the Institute via student representatives in various Institute committees.

Boarding and Lodging

The Institute has a fully residential beautiful picturesque campus, spread over 1055 acres of land, with all modern amenities. It has about 2750 undergraduate and 1680 postgraduate students, around 350 faculty members and 650 supporting staff. A shopping complex, branches of State Bank of India and Union Bank of India, a post office, and other amenities fulfill the needs of the campus community. The students are accommodated in nine boys' hostels and two girls' hostels. All rooms in the hostels have provisions for internet connectivity and connection to other computers through Local Area Network.

Health Care

Equipped with pharmacy, clinical laboratory and a 30-bed indoor ward, the Health Centre provides medical help and emergency care to the campus community round-the-clock.

Recreational/Extra-Curricular Facilities

A number of extra-curricular activities, recreational as well as managerial, are an integral part of the educational experience at IIT Kanpur. All such activities are coordinated by the Students Gymkhana. Students are involved in all decision making bodies, including the administration of academic programmes, hostel management and even disciplinary matters. Further, students organize events such as Antaragni—the all India cultural festival, Udghosh—the all India games and sports festival, and Techkriti—the all India science, technology and entrepreneurship festival. These events draw participation from academic institutions all over the country. In addition, students organize a large number of extracurricular events encompassing literary, cultural and sports aspects through a number of clubs and societies. These include Adventure Club, Nature Club, Astronomy Club, Photography Club, Students Film Society, Aero-modelling Club, Gilding Club, Robotics Club, HAM Club, Music Club, Dance Club and Theater Workshop, etc. The Institute has an Olympic-sized swimming pool, excellent indoor and outdoor sports facilities and a 1200-seat auditorium with excellent acoustics. A strong NSS programme to inculcate social values in students and their personality development is also conducted.

Financial Assistance/Scholarships

A large number of scholarships are available to the students at IIT Kanpur.

Training and Placement

The Institute has a very active Student Placement Office that coordinates Campus Recruitment. It is housed in the Outreach Building with excellent facilities and support to prepare and train students for placement. A very large number of national as well as international companies visit the Institute to hire the students.

Rules for Change of Branch

A student may be allowed to change the branch/programme subject to certain constraints on the number of students in each branch/programme. Some of the guidelines used for branch/programme change are as follows.

1. The strength of any branch/programme should not exceed the larger of its existing and sanctioned strengths, and should not fall below 60% of its sanctioned strength due to change of branch/ programme.
2. All cases are decided in decreasing order of Cumulative Performance Index (CPI) of the eligible applicants.
3. A student without any slow-paced course or with a slow-paced course in English only, can apply for a branch/ programme change at the end of second, third and fourth semesters. The eligibility criteria depend on the semester at the end of which the student makes the application. However, these cases are decided on the basis of the CPI up to the first two semesters only.
4. A unique aspect of IIT Kanpur rule is that branch change is allowed not just after second semester but also after 3rd and 4th semester.
5. Branch change is allowed from any program to other including B.Tech, M.Sc.(Integrated) and B.Tech.-M.Tech. dual degree programs.
6. Branch change is permitted from B.Tech. to B.Tech.-M.Tech. dual degree in the same department till seventh semester.
7. Relaxed eligibility criteria are adopted for students of SC/ ST categories.

2.9 INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

The Indian Institute of Technology Kharagpur was founded in 1951. A forerunner of the other fourteen IITs, and in many ways a role model for them, IIT Kharagpur has been producing scientists and technologists of the highest caliber who continue to provide leadership in education, research, industry, and management. Many of its alumni are illustrious men and women whose achievements command admiration and respect everywhere and evoke a just sense of pride in the IIT community.

Situated 120 km west of Kolkata, Kharagpur can be reached in about two and a half hours by train from the Howrah railway station of Kolkata. Kharagpur is also connected by direct train service to other major cities of the country. The Institute is about 10 minutes' drive (5 km) from Kharagpur railway station. Located in a sylvan landscape, far from the heat and dust of the city, the campus provides a calm and serene environment for dedicated academic pursuits. IIT Kharagpur has two extension centers, one at Calcutta and the other at Bhubaneswar, besides the main campus at Kharagpur, which is the largest in the country.

IIT Kharagpur has the largest number of PG and UG programmes and has a large number of doctoral research scholars. It offers 22 undergraduate (B.Tech., B.Arch., M.Sc.), 87 postgraduate (M.Tech., Dual Degree, M.C.P., M.B.M.) and research (M.S., Ph.D., D.Sc.) programmes.

IIT Kharagpur has been a prime mover in the modernization of technical education in independent India. Excellent research facilities and support in the frontier areas of science and technology are available at IIT Kharagpur, which includes some of the most advanced laboratories and the largest technical library in the country housing a state-of-the-art electronic library. All the departments and centres are equipped with modern instruments. The Central Research Facility caters to the special needs of all including outside organizations. The Institute also houses an Astronomical Observatory set up by the Positional Astronomy Centre, Government of India and the ISRO Satellite Remote Sensing Centre. A well-equipped centre for Education Technology, and Language and Psychology laboratories are additional assets. Many special purpose top rung laboratories have been created in IIT Kharagpur out of the R&D grants received from Industries, Government, Defence and from Alumni Contributors. A large new Computer and Informatics Centre, a new wing for Information Technology, computer network for halls of residence, students' hostels rooms and a capacious lecture hall complex are fully operational. Some of the laboratories are: a world class VLSI Design Laboratory, Communication Empowerment Laboratory, Media Lab Asia, Microsoft Laboratory, Motorola Laboratory, Centre for Excellence in Composite Technology, Ocean Science and Technology Cell, Advanced Technology Centre, Space Technology Cell, etc. Vinod Gupta School of Management (VGSOM) and G S Sanyal School of Telecommunications (GSST), the first of their kinds in the IIT system, owe their existence to the generous contributions of two of its alumni.

Flexible Curricula

In the new millennium, IIT Kharagpur has switched over to a more flexible academic system aiming at capability-based learning where students would get wider options to exercise and brighter students would be able to achieve more. Over and above receiving a B.Tech. (Hons.) Degree, a B.Arch. (Hons.) Degree, a Dual Degree or an Integrated M.Sc. Degree, for which he/she has registered, a student depending on his/her performance and availability would have the option to earn additional credits across disciplines. On accumulation of sufficient prescribed credits, a student would be able to earn a MINOR in a discipline other than the degree for which he/she has registered. For example, a student in Electrical Engineering (EE), say, would obtain a B.Tech. (Hons.) degree in EE and can earn a MINOR in Computer Science and Engineering (CSE) or Mechanical Engineering (ME), or even a MINOR in a science discipline. Provisions have been kept in the curricula so that a student has the freedom to pursue and sustain multidisciplinary interest.

The Institute follows a seven-point grading system with letter grades and the corresponding grade points per credit. The Cumulative Grade Point Average (CGPA) is computed at the end of each semester. The CGPA secured by a student reflects his/her performance. .

Boarding and Lodging

The institute is fully residential. Students are accommodated in 18 Halls of Residence. All the Halls of Residence have regular catering facilities. Some shops are located within the Institute premises to serve tea, coffee, soft drinks and light snacks. For daily necessities and groceries, one can walk down to the Tech Market. A larger market, Gole Bazaar is about 5 km from the Campus. Three banks with ATM facility are located inside the Campus. The State Bank of India is close to the Institute and provides foreign exchange facilities also. The Syndicate Bank is situated on the first floor of the Institute main building. The Punjab National Bank is situated in the Tech Market where business transactions are carried out in the afternoon. The Post Office is located close to the State Bank. Full postal and telegraphic service is available at the Post Office.

Recreational/Extra-Curricular activities

IIT Kharagpur aims at the all round development of personality, with emphasis on physical, socio-cultural and value-oriented education. In the rich tapestry of culture that marks this IIT, students play a vital role. They participate in almost all decision-making bodies of the Institute including its Senate and organize cultural activities throughout the year, culminating in the Spring Fest.

Technology Students' Gymkhana, the nerve centre for sports, cultural and social activities, puts a premium on creativity and teamwork. It has a number of outdoor and indoor stadia for sports and games, a modern swimming pool and a gymnasium. Photography Club, Fine Arts Club, Publicity Club, Music Club, Yoga Club, Film Society, Dramatics Society, Aquatics Society, Astronomy Club and many more special interest groups are supported by the Gymkhana.

Health care

The B.C.Roy Technology Hospital is located at the center of the Campus. It provides indoor and outdoor medical facilities for common ailments. Complicated cases are referred for treatment to the State Hospital or to the Railway Hospital or to the Hospitals at Kolkata. Various medical practitioners are available around IIT and a list of neighbourhood medical facilities is available in the website - http:// noticeboard.iitkgp.ernet.in/hospi.html

Financial Assistance/Scholarships

The Institute also offers a very large number of scholarships, medals and prizes which is made possible by the munificence of its well-wishers, providing due recognition and reward for merit.

The Institute award merit-cum-means scholarship to all eligible students of 4-year B. tech, 5-year Dual Degree, 5-year B. Arch., 5-year M.Sc. courses subject to a maximum number of 25% of the total number of students of that sessions. Apart from this various endowment scholarships are also available.

The sponsored research and consultancy projects generate significant amount of fund and provide generous support for undergraduate students doing good projects.

Training and Placement

The Training and Placement Section of the Institute centrally handles campus placement of the graduating students of all Departments, Centres and Schools. The Section provides excellent infrastructure to support every stage of the placement process. Arrangements for Pre-Placement Talks, Written Tests, Interviews, Group Discussions etc. are made as per the requirements of the Organizations. The section also arranges for summer practical training for all prefinal year B.Tech. (Hons.) Students and third year students of 5 Year dual degree M.Tech courses.

The Science and Technology Entrepreneurs' park (STEP) of IIT Kharagpur has given a fillip to entrepreneurial activities in the region.

Rules for Change of Branch

The Institute may permit a student of B.Tech. or integrated M.Sc. Course (except for B.Arch. students) to change from one branch of studies to another after the first academic year (first two semesters). Only those students will be eligible for consideration for a change of branch who has completed all credit courses in the first two semesters in their first attempt and obtained a CGPA of not lower than a prescribed value at the end of second semester.

Change of branch shall be permitted strictly on the basis of inter-se-merit of the applicants. For this purpose, the CGPA obtained at the end of the second semester shall be considered. If there is any tie, it will be resolved by considering the JEE rank of the applicants.

1. In making the change of branch, those applicants, who have secured a rank within the top one percent, shall be allowed to change the branch to their choice without any constraint.
2. The remaining eligible applicants shall be allowed a change of branch strictly in order of their inter-se merit, subject to fulfillment of both the constraints given in (a) and (b) below.
   (a) The actual number of students in the third (autumn) semester in the branch to which the transfer is to be made, should not exceed 110% of the number of students on roll in that branch in the previous semester.
   (b) A maximum of 10% students registered in a branch can go out from that branch due to branch change.
3. The applicants registered for a Dual Degree Programme will be considered for change of branch to another Dual Degree Programme only, for which the above norms will be applicable.

All changes of branch made in accordance with the above rules will be effective from third (autumn) semester.

2.10 INDIAN INSTITUTE OF TECHNOLOGY MADRAS

The Indian Institute of Technology Madras (IITM) is among the finest, globally reputed higher technological institutions that have been sensitive and constructively responsive to student expectations and national needs. IITM was founded in 1959 as an 'Institute of national Importance" by Government of India with technical and financial assistance from the Federal republic of Germany. The institute offers high quality academic programmes leading to B Tech, M Tech, Dual degree M Tech, Dual degree BS and MS in Physics, MSc, M S, M.A, M B A, and PhD degrees through its technology, engineering, science, management and Humanities and Social Sciences Departments. Young students seeking a wholesome academically rigorous intellectually challenging personally enriching and value laden educational experience have for long found IIT Madras an ideal institute for pursuing their higher studies.

IIT Madras campus is famed for its scenic serene and stimulating natural environment. Comprising 650 acres of lush green forest, including a large lake and variety of flora and

fauna, the campus is the pride of its residents and provides an ideal setting for serious academic and other developmental pursuits.

State of the art education, research and general campus infrastructure is provided in tune with the institute's nation-centric vision and to support its inspiring and challenging academic programmes. Our workshops, laboratories, computing infra-structure, library, hostels and other campus facilities provide to the country's best talent, a living, learning and working environment that enables cutting edge work. Leading institutions and organizations across the world actively collaborate with us through a variety of projects, programmes and schemes. Generally, our faculty and students jointly work on all of these, including large scale socially relevant projects for our nation and people.

Academic Programme

The four year B Tech and the five year dual degree (B Tech + M Tech and BS + MS) programmes consist of an amalgamation of core courses in the chosen engineering/ science discipline along with courses in basic sciences, humanities and practical engineering skills. Laboratory courses and an industry internship give students a platform to test the fundamentals acquired in the classroom. The institute follows a policy of relative grading and continuous assessment done through numerous class tests, assignments and examinations.

The curriculum of the five year dual degree programme is common with the four year programme for the first three years, after which electives are offered in the chosen M Tech specialization.

Students admitted to IIT Madras in four year B Tech or five year dual degree (B Tech and M Tech) programmes can opt for B Tech (Honours) at the end of the fourth semester of the programme. They should have a CGPA of 8.5 and above, and should have cleared all the courses as prescribed in the curriculum in the first attempt. In addition, B Tech (Honours) students must register for additional courses for the 12 PMT credits and a project work. Dual degree students who meet the above criteria will be awarded B Tech (Honours) and M Tech degree.

The Curriculum

With our focus on research and development, in the complex changing scenario of today's industry, our curriculum constantly reflects key trends and upcoming areas of interest. It is reviewed regularly and changes are incorporated to enable our students to be in dynamic equilibrium with their world and time. The greatest strengths of the IITM curriculum are its flexible rigor and the variety it offers one to pursue one's interest in diverse disciplines ranging from engineering, technology, the pure sciences management and humanities and social sciences including economics, sociology, philosophy and literature. Interdisciplinary learning is stressed and achieved through our policy of giving our students a great deal of freedom in choosing their electives and minor streams. The curriculum, pedagogy and the atmosphere together infuse in our students a strong spirit of inquiry joys of learning and the excitement of knowledge discovery.

Rules for Change of branch

The academic programmes offer ample flexibility. For instance, students can change their branch to a more preferred one at the end of the first semester depending on their academic performance. Dual degree students are permitted to change to other dual degree programmes. However, change of branch from Engineering design dual degree (M92 and M93) to other branches and from other branches to M92 and M93 is not permitted in view of the specialized nature of the curriculum and course contents of these dual degree programmes. Changeover from a B Tech course to a dual degree course within the same department is permitted at the end of sixth semester. All changes are subject to certain institute rules which are available in the institute website.

Please visit *http://www.iitm.ac.in* for full information details and clarifications.

Co-curricular and Extra-curricular activities

To foster the spirit of engineering among the students, a number of hobby clubs including Robotics, Astronomy and Rocketry to name a few, function vibrantly. These provide students with opportunities to innovate and implement their own ideas and designs, develop a passion for technology, under the able guidance of faculty. Nowhere is this zest for technology so aptly displayed as in Shaastra, the IIT Madras annual technical festival. Shaastra has the unique distinction of being the first ISO9001 certified technical festival in our country.

The centre for Innovation houses state of the art equipment and instruments that students can use to transform their creative ideas into proof of concept or prototypes of useful products. The Centre for Technology Innovation Development and Entrepreneurial support (CTIDES) kindles the students' entrepreneurial spirit and helps them to form companies and launch their products.

The students also learn a lot from eminent personalities across various fields through the extra mural lectures organized frequently every semester.

Personality development is also an integral part of education and students at IITM are presented with ample opportunities to develop into all round mature responsible individuals. Students can choose to pursue almost any interest being quizzing, music theatre, public speaking, creative writing, photography, trekking or sports. Medleys of clubs organize meetings and workshops throughout the year.

The cultural fever reaches its annual peak in January when Saarang the IIT Madras cultural festival happens. Its keenly contested events and performances by renowned national and international artists make it an unforgettable experience for all the participants.

'A healthy mind resides in a healthy body'. In order to encourage overall development of a student, the institute places emphasis on sports and physical fitness. With enviable facilities it comes as no surprise that our students, year after year, prove their mettle by emerging winners in many meets. The General Championship at inter IIT sports meet has often been won by IITM. The institute has an Olympic size swimming pool, a well equipped fitness centre and Gymnasium, the lush green Chemplast Cricket ground, flood lit tennis, badminton and volleyball courts along with sprawling grounds for football hockey and athletics. There are good facilities for other games and sports such as table tennis, bridge, billiards, skating etc. Various inter hostel sporting events are held round the year and the winner gets to keep the coveted Schroeter rolling trophy. Students must enroll in one of the NCC/NSO/NSS programmes for a year as part of their B Tech programme requirements.

Facilities

The recent renovation of hostels has provided residents with not only extremely comfortable living conditions but also with a 24 hour internet connectivity and clean water supply. The institute has a well run hospital with a 24 hour pharmacy. There are three restaurants that cater to a diverse set of tastes, a power laundry, 24 hour ISD/STD booths, ATM counters of various banks and an expansive open air theatre in which movies are screened every week. In order to make transition to college life as smooth as possible, the institute's Guidance and Counselling unit helps students tackle problems they may face. All students are assigned faculty advisors and student counselors to guide them in addressing issues of concern. As students continue through their year at IITM they are given more and more responsibility giving them an active say in deciding institute policies.

Industry and Alumni Relations

IITM is actively involved with national and international organizations through its Centre for Industrial Consultancy and Sponsored Research (IC&SR). Set up in 1973, the IC&SR) plays a vital role in bringing together industry professionals and faculty of the institute for gaining insight and solving challenging problems. These joint efforts result in significant contributions to technology design and development, improved efficiencies in industrial performance and increasing care for the integrity of our national environment. Students are actively involved in all these efforts.

IITM enjoys a warm affectionate relationship with its over 30000 alumni located all over the world. The alumni have extended intellectual and financial support that has enabled the institute to build infrastructure for learning and living in its beautiful campus and also establish various advanced facilities.

2.11 INDIAN INSTITUTE OF TECHNOLOGY MANDI (HIMACHAL PRADESH)

IIT Mandi, one of the new IITs started by the Ministry of Human Resources Development, Government of India, is the only IIT located in the Himalayas. Its final location will be in picturesque Kamand, 14 km outside the town of Mandi, Himachal Pradesh. For the first year (2009-10), classes were held in the campus of the mentor, IIT Roorkee. From July 2010, the Institute will function in a transit campus in Mandi town for about 2 years before shifting to the permanent campus in Kamand.

Academic Programmes

To start with, 4-year B.Tech. programmes are offered in three branches, viz., Computer Science and Engineering, Electrical Engineering and Mechanical Engineering with 40 students in each branch. The curriculum, course structure and syllabi, and the fee structure were initially the same as those of the mentor IIT. From July 2010, they will evolve independently. The goal of the new curriculum is to train students to become design engineers capable of conceiving, designing and deploying innovative and cost-effective products and processes for widespread use in society. To this end, there will be a strong emphasis on laboratory and project work from the first year to complement theory.

Computer Science & Engineering trains students in programming, theoretical foundations, design of computer hardware and software, networks, artificial intelligence, databases, human-computer interfaces, etc. Electrical Engineering at IIT Mandi includes communications, electronics, VLSI, electric power systems, and electrical machinery. Mechanical Engineering covers materials, manufacturing processes, design of machinery, vehicles, etc.

IIT Mandi plans to have about 20 full-time faculty in 2010-11. They will be in the disciplines of computer science, electrical engineering, mechanical engineering, maths, physics, chemistry, humanities and social sciences. In addition, a few faculty from IIT Roorkee, IIT Madras and other established institutions will teach certain courses part-time.

The Transit Campus

From July 2010, the Institute will function in a transit campus in Mandi town. Mandi town is on the national highway from Chandigarh to Kullu/ Manali. The distance of 200 km from Chandigarh can be covered in 5 hours by car and 7 hours by public bus. The transit campus, located in the Vallabh Degree College, has a large Academic Block on the bank of the River Beas. This has classrooms, laboratories and faculty offices.

Shared sports facilities include cricket, football, hockey, tennis, badminton, table tennis, swimming, all within a few minutes of the Academic Block. Trekking, mountaineering and cycling will also be encouraged.

The Institute is fully residential. There is a 100-seat hostel for the first year boys adjacent to the Academic Block and another 100-seat hostel for the second year boys about 2 km away. The 25-seat hostel for girls is located along with faculty residences on a hill overlooking the campus.

Health Care

While in the transit campus, medical care will be provided through arrangements with some of the many doctors and clinics located in Mandi town. The Kamand campus will have a hospital. Specialty care is available in Chandigarh.

Financial Assistance/Scholarships

The institute offers Merit-cum-Means scholarship for BTech students.

Rules for Change of Branch

A student enrolled in any academic programme through the Joint Entrance Examination (JEE), is eligible for change of branch/programme at the end of the first year provided that he/she satisfies the following criteria:

1. Earned credits at the end of 1st year must be at least 48, and CGPA must be at least 6.5 for SC/ST category, at least 7.5 for other categories. The credits for NCC/ NSS/NSO/ Rangering, proficiency and discipline shall not be counted for the calculation of CGPA and earned credits for this purpose.
2. While making the change of branch of a student, the strength of a class should not fall below the existing strength by more than 10% and should not exceed the sanctioned strength by more than 5%. For this purpose, the strength refers to the total strength of the students in the class of a given branch excluding the direct admissions and failures.
3. A student who has secured a rank within the top 1% and satisfies the criteria for eligibility of change of branch shall be allowed change of branch to his/her choice without any constraint if he/she applies for it. The remaining eligible applicants shall be allowed change of branch strictly on the basis of inter-se-merit as reflected in their CGPA. In case the CGPA of more than one student seeking change of branch is same, their inter-se-merit shall be decided on the basis of their ranks in JEE provided that a student of general category shall not be allowed change of branch/ programme against the vacant seats of SC/ST category.
4. If a student with higher CGPA is not offered a particular branch because of other constraints, this will not be offered to any other student with a lower CGPA even if he/she is eligible for change of branch on the basis of the regulations above.

2.12 INDIAN INSTITUTE OF TECHNOLOGY PATNA

IIT Patna was established by an act of Parliament in August 2008. It is one of the eight new IITs, so established. Presently, it is operating from a makeshift campus located in Patliputra Colony, about 5 km from Patna Railway Station. The permanent campus is expected to come up within the next two to three years at Bihta, a suburb of Patna. Patna is the capital city of the state of Bihar and is situated on the banks of the river Ganga. The region has rich history dating back to 500 BC. Some of the famous tourist sites near Patna include Nalanda, Bodhgaya and Vaishali. Patna is well connected to other parts of India by road, rail and air.

Academic Programmes and Facilities

IIT Patna is currently offering B.Tech programmes in three disciplines- Computer Science and Engineering, Electrical Engineering and Mechanical Engineering. All the seven departments- Computer Science and Engineering, Electrical Engineering, Mechanical Engineering, Physics, Chemistry, Mathematics and Humanities & Social Sciences are running PhD programmes.

The B.Tech. programmes consist of 8 semesters spread over 4 academic years. A student takes 5 to 6 theory courses in addition to laboratory courses in each semester. Credits are allotted to various courses depending on the number of lecture/ tutorial/laboratory hours per week. A student's performance in a course is continuously evaluated throughout the semester and culminates in the award of a grade on a 10-point scale. The students' Semester Performance Index (SPI) is evaluated by weighted average of grade points secured in all the courses registered by the student in that semester. The Cumulative Performance Index (CPI) representing the weighted average of the grade points secured by the student in all the semesters is also recorded.

The makeshift campus has sufficient basic infrastructure required to run B.Tech. programmes in Computer Science and Engineering, Electrical Engineering and Mechanical Engineering. The makeshift campus has five buildings: a four-storey academic building, a two-storey science block, a two-storey STPI building, and two other buildings housing the Mechanical Engineering Workshop and Electrical Engineering Workshop.

The Academic building has classrooms equipped with modern audio-visual electronic gadgets, state-of-the-art laboratories in Chemistry, Physics, and Computer Science. It also houses a Computer Centre with 4 MBPS BSNL Internet connection and adequate server infrastructure. Laboratories in Basic Electronics, Analog Electronics, Digital Electronics, VLSI, Control and Communication are all located in this building.

The building also has a central library, the administrative office, a dispensary, a cafeteria and faculty chambers. The central library is stocked with sufficient number of text and reference books. On line access to various technical and scientific journals under the INDEST-AICTE Consortium is available.

The STPI building has a conference room, a placement cell and faculty chambers. It will also have a Hardware Laboratory of the Computer Science Department and the Embedded Systems, DSP and Simulation Laboratories of the Electrical Engineering Department in the near future.

The Mechanical Engineering Workshop building houses all the Mechanical Engineering Laboratories, viz. Basic and conventional manufacturing labs, CAD/ CAM Lab, Robotics and Automation Lab, Fluid Mechanics/Machinery Lab, Heat Transfer and Data Acquisition Lab, IC Engines Lab, Material Testing Lab, Dynamics of Machines Lab and Metrology Lab.

The Electrical Engineering Workshop building has an Electrical Machines Laboratory and an Advanced Electrical Engineering Laboratory.

The Science block has classrooms, faculty chambers and advanced laboratories for Physics, Chemistry and Mathematics departments. This includes Materials Research Lab and Optics Research Lab of the Physics Department, Chemistry Instruments Lab and Chemistry Research Lab of the Chemistry Department and Computational Research Lab of the Mathematics Department.

National Knowledge Network has equipped IIT Patna with a 1 GBPS internet connection for video conferencing and for running a virtual classroom.

IIT Patna has a team of 34 young and dynamic faculty members. Thirteen more are expected to join by July 2010. These faculty members are actively engaged in teaching, research and developmental activities of the institute. They are accommodated in nearby apartments.

IIT Patna has signed MoU with the University of Houston, USA and Louisiana State University, USA for undergraduate students exchange , research collaboration etc..

Boarding, Lodging and Other Facilities

There are two boys' hostels which can accommodate more than 200 students. A third hostel is expected to come-up by July 2010. Normally, students are provided with double bedded accommodation. The hostels are located close to the campus. The girl students are accommodated in rented flats in a nearby locality. The hostels are equipped with uninterrupted power and water supply. The hostels rooms are also provided with internet connections. For recreation and entertainment of the students, the hostels have facilities for indoor games such as Table Tennis and Carom. It also has a TV room. To keep the students fit and healthy, a well equipped gymnasium is also provided in the hostel. A basket ball court inside the hostel premises has also been constructed. The hostel wardens live in rented flats situated within about 500 meters from the boys' hostel. A one hour per day for five days in a week outdoor health service is available at the Institute through a private hospital. A contract has been signed with two private hospitals for credit based indoor service. These private hospitals are at distance of approximately 2 km from the hostels. A 24-hour ambulance services is also provided by these hospitals in case of emergencies. Students of IIT Patna are covered under the mediclaim insurance policy.

Students of IIT Patna are actively involved in extra-curricular and co-curricular activities. They have organized their annual function of IIT Patna 'Anwesha-10'. On this occasion, the students were given awards for their contributions in sports and other extracurricular activities. The other events organized by the students of IIT Patna are Nebula-09, Reverberance-09 and Robomerz-10.

The institute also provides Merit-cum-Means Scholarships to B. Tech. students on merit basis and to those having financially weak backgrounds.

Rules for Change of Branch

The Institute permits a limited number of students to change from one branch of study to another after the end of the second semester, subject to certain conditions, some of which are given below:

1. Only those students will be eligible for a change of branch who have completed all the common credits required in the first two semesters of their studies in their first attempt with a CPI of not less than 8.00 and without having had to pass any course requirement in the summer term examination.
2. Change of branch is permitted strictly on the basis of merit (CPI at the end of two semesters) subject to the limitation that the strength of a branch does not fall below the existing strength by more than ten percent and does not go above the sanctioned strength by more than ten percent.

2.13 INDIAN INSTITUTE OF TECHNOLOGY RAJASTHAN

History

IIT Rajasthan is one of the new IITs set-up by the Ministry of Human Resource Development (MHRD), Government of India. IIT Kanpur has been mentoring IIT Rajasthan over the last two years as per the dictates of the Government of India, Ministry of HRD Order No. F.No. 11-10/2008-TS. I (Pt.) dated May 9, 2008.

Currently, IIT Rajasthan is located in the Sun City of India, namely, Jodhpur. Functioning from a temporary campus, the institute has already acquired land and is expected to be fully functional within two to three years.

Currently 214 students are enrolled at IIT Rajasthan. Thus far IIT Rajasthan was functioning from the IIT Kanpur campus, duly sharing the facilities of its mentor institute on a shift basis. However, from the forthcoming session, all academic and lab facilities shall be available to students of IIT Rajasthan at the institute's new site, the MBM Engineering College in Jodhpur.

Location and Accessibility

At present IIT Rajasthan is functioning from the campus of MBM Engineering College affiliated to Jai Narain Vyas University in Jodhpur, Rajasthan. Notably, Jodhpur is well connected with all parts of India by rail and air. MBM Engineering College is situated at a distance of 4 km from the Jodhpur Railway Station and 3 km from the Jodhpur Airport.

Academic Programs

IIT Rajasthan currently offers the 4-year B. Tech. program in three areas along with its research program. Undergraduate courses are offered in:

1. Computer Science and Engineering,
2. Electrical Engineering and
3. Mechanical Engineering

The sanctioned student strength is 40 in each branch. New undergraduate curriculum would be implemented from this year which in addition to science based engineering education, puts equal emphasis on system engineering and design, project work and entrepreneurship.

Facilities Unique to the Institute

At present the students of IIT Rajasthan have the opportunity to work in an upcoming institute that provides them with hands-on experience in addition to their regular academic and lab sessions. Not only do IIT Rajasthan students have the opportunity to learn from national and international faculty, they also have the option to observe and participate in a truly interdisciplinary academic ethos that IIT Rajasthan envisions to acquire. IIT Rajasthan, therefore, promises to its students world-class learning facilities which shall help them acquire leadership skills and the acumen for independent thinking.

Notably, the French Government has shown a keen interest in helping IIT Rajasthan to develop into a world class research and academic institute. Further, IIT Rajasthan is in the process of forging strategic alliances with several leading French Universities that will result in student and faculty exchange, internship in France and participation in strategic joint research programs.

Boarding and Lodging

With the academic session beginning in July 2010, students of IIT Rajasthan will be accommodated in a beautiful new campus built for central government employees. This campus, namely, the GPRA campus in Vivek Vihar colony is located in Kendranchal, Jodhpur. It is situated at a distance of 17 km form the railway station and 16 km from the airport. Students shall be accommodated in the residential flats within the said campus. The campus shall also house the faculty and staff members of the institute. Students would be sharing rooms and live in a campus that is well guarded and equipped with all basic requirements of a residential colony. Transport facility to MBM College for attending classes and lab sessions shall be arranged.

Recreational/Extra-Curricular Facilities

The students shall also be encouraged to participate in co-curricular activities that will help them acquire all round leadership skills, besides organizing stimulating talks and guest lectures by experts. The extra curricular activities shall include participation in the Book Club, the Science & Technology Council, Photography, Sports, Astronomy and Films, among others.

Health Care

IIT Rajasthan has tie-ups with leading hospitals of Jodhpur. Emergency services such as first aid and ambulance are provided both at the academic and the residential sites of the institute. All students would be covered by medical and accidental insurance.

Financial Assistance/Scholarships

Merit-cum-Means Scholarships are awarded to deserving candidates. However, the Director has a discretionary power to provide financial aid and help to students who need special consideration.

Training and Placement

IIT Rajasthan is committed to develop an environment where students choose their vocation that sustains their long term interest. Another objective is to integrate student learning with industries and enhance their employability skills through activities such as industry and lab tours covering diverse central labs. Further, efforts shall be made to help students develop a network with experts and eminent persons, which shall also help them in securing good jobs. A formal policy having rules for training and placement shall be formulated shortly.

Branch Change Rules

Change of the branch will be permitted strictly in the order of merit as determined by their Cumulative Performance Index (CPI) at the end of Semester II. In case of a tie, the JEE rank of the tied applicants will be considered.

1. Eligibility Criteria

   (a) The CPI at the end of second semester should

      i. Equal to or greater than 7.0 for SC/ST applicants

      ii. Equal to or greater than 8.0 for other applications

   (b) Student should have passed all the courses till second semester (Including the courses in which S/X grades are awarded)

2. Strength Constraints

   No branch may exceed 105% of its sanctioned strength or fall below 75% of its sanctioned strength as a result of these changes.

3. Procedure

   As many programme changes as possible are granted to the students in the decreasing order of CPI, subject to the availability and strength constraints of the branches/schools.

2.14 INDIAN INSTITUTE OF TECHNOLOGY ROPAR

Indian Institute of Technology Ropar is one of the eight new IITs set up by the Ministry of Human Resource Development (MHRD), Government of India in 2008. In true tradition of IIT system, this institute is committed to providing state-of-the-art technical education in a variety of fields and also for facilitating transmission of knowledge in keeping with latest developments in pedagogy. IIT Delhi was assigned the responsibility of mentoring IIT Ropar. The first academic session (2008 – 09) of IIT Ropar was conducted at IIT Delhi campus. The institute currently operates from the premises of Government Polytechnic College for Girls (Ropar), which has been full renovated and furnished. The temporary campus for IIT Ropar is set up with all the facilities as required. Class rooms fitted with multimedia, faculty room's administrative wing are all in place. There are four hostels; three for boys and one for girls equipped with modern messing units in place and operational. Faculty recruitment, creation of laboratories and other support facilities are in full swing. The Institute is operating from the transit campus at Ropar from this session and has started the classes from 18th August 2010. In a few years, the institute will be relocated to its own campus, spread over a 500 acre area, along the banks of the river Satluj. Note: IIT Ropar was previously called IIT Ropar.

Location

The Institute is located in Ropar, the headquarters of Rupnagar district, Punjab. This institute, with its establishment, joins a string of premier educational institutions in this part of the state of Punjab. The town of Ropar, the district headquarters, is 42 kilometers from Chandigarh, the capital of Punjab. Rupnagar is well connected by both road (National highway NH-21) and railways (the Delhi-Ambala-Una railway line passes through Rupnagar). The nearest airport, in Chandigarh, is about 60 kilometers from Rupnagar. Mohali, the nearest major city, will soon have its own international airport.

Academic Programmes

At present, the institute offers a 4-year programme leading to the Bachelor of Technology (B. Tech.) degree in three disciplines, viz., Computer Science and Engineering, Electrical Engineering, and Mechanical Engineering, with a sanctioned intake of 40 students in each. The curriculum followed at IIT Ropar provides for a comprehensive technical education, with a view to produce quality engineer-scientists. It facilitates broad-based knowledge acquisition and, simultaneously, nurtures a temper for life-long learning and exploration. Students are encouraged to go beyond the classroom to conduct and carry out independent work by means of research projects, guided reading, and by allowing them to join the research activities undertaken by faculty members. The idea behind such a fashioning of the curriculum is the belief that classroom activities must be supplemented by independent study and also by individual research that broadens one's horizon and provides for opportunities to bring one's ideas to fruition.

Boarding and Lodging

The Institute campus houses four hostels: Jupiter, Mercury, and Mars Hostels for boys and Venus Hostel for girls. The hostels are well equipped for comfortable lodging and boarding of approximately 360 students. All hostels are provided with water coolers and RO systems. Each hostel has a common room that provides facilities for indoor recreation and games. The hostel complex also includes four shops that cater to the basic needs of the residents, and also a few washing machine facilities.

Recreational/ Extra-curricular Activities

At present, the transit campus has excellent facilities for several sports, including a cricket field, three lawn tennis courts, a football field, a hockey field, a gymnasium, a basket ball court, badminton courts, an athletics track, table tennis and also a number of facilities for several athletic events. The institute also encourages its students to participate in inter-IIT sport events and other competitions. Space for recreational and creative activities is also available.

Health Care

The institute has allocated a separate building, which adjoins the hostel complex, for its medical facility. A doctor and a

nurse have been appointed to attend to medical emergencies of the campus residents. In addition the institute relies on a few super-specialty hospitals in the city of Ropar and Chandigarh for providing medical care to its members.

Financial Assistance/Scholarships

The institute offers Merit-cum-Means scholarship to about 25% of the students. The recipients of the scholarship are exempted from paying the tuition fee and get a scholarship of Rs.1000/- per month. The criteria for the same are based on the following:

- ALL INDIA RANK (AIR) in the JEE and
- Means (only those students are eligible, whose parental income is below Rs.2 lac per annum.)

Further as per IIT rules, there is a limit that the total scholarship received from all sources for a student should not exceed Rs.50,000/- per annum.

IIT Ropar also has a provision of Institute Free Studentship to 10% of the students on the basis of means only. The recipients of the Free studentship are exempted from paying the tuition fee. The criteria of 10% free studentship is similar to that of MCM Scholarship, for the first year is based on parental income limit of Rs.2 lacs per annum. Also all SC and ST category students are given full tuition fee waiver irrespective of their parent's/guardian's income. Besides these, the institute also offers merit prizes and certificates to the top 7% of the students of each 4 year B. Tech program for 1st & 2nd Semester. The value of merit prize is Rs.2500/-. Many other organizations in India and Abroad also offer some assistance to the students of IIT Ropar.

Rules for Change of Branch

1. A student is eligible to apply for change of discipline at the end of first year only, provided he/she satisfies the following criteria:-
   (a) CGPA for GE/OBC category student is a 7.50 or greater.
   (b) CGPA for SC/ST/PH category student is 6.50 or greater.
   (c) Earned credits at the end of first academic session are 40 credits or more.
2. Change of the discipline will be permitted strictly in the order of merit as determined by their CGPA at the end of first year subject to the limitation that the actual number of students in the third semester in the discipline to which the transfer is to be made, should not exceed the sanctioned strength and the strength of the discipline from which transfer is being sought does not fall below 90% of existing strength.
3. For a student with CGPA 9.0 or more, even if a vacancy does not exist, he/she will be permitted to change provided the strength in the discipline to which the change is being sought does not exceed by 5% of the approved strength.
4. A student with CGPA 9.0 or more will be permitted to change discipline even if strength of the discipline from which change is being sought falls below 90% of the existing strength.
5. Stipulation of minimum credits and CGPA requirements will not be insisted upon for change of discipline to a branch in which a vacancy exists and the concerned student was eligible for admission to that discipline at the time of admission to IIT Ropar. However, requirements of credits and CGPA will continue to apply in case of all students seeking change to a discipline to which the concerned student was not eligible for admission at the time of entry to IIT Ropar.

2.15 INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

IIT Roorkee is an Institute with a long and illustrious history. It started as Roorkee College, the first Engineering College in South Asia, in 1847. The institute was renamed as Thomason College of Civil Engineering in 1854 and was rechristened, in 1947, as Thomason College of Engineering. On November 25, 1949 it became the University of Roorkee, the first engineering university of independent India, and finally, an IIT on September 21, 2001 by an Act of Parliament. Beside its main campus at Roorkee, the Institute has another Campus at Saharanpur (50 km from Roorkee).

The Institute has 18 academic departments, supported by 4 centres of excellence (like AHEC, Nanotechnology, Disaster Management and Transportation Systems), 6 academic and service centres (like Institute Computer Centre, Information Superhighway Centre, Instrumentation Centre, etc.) which offer 11 undergraduate courses in engineering and architecture, 5 Integrated dual degree courses and 51 postgraduate courses in engineering, architecture, sciences, computer applications and business administration, besides research programmes at doctoral and post-doctoral levels in the cutting edge areas of technology and sciences. The academic programmes in Paper Technology and Polymer Science and Technology are run at the Saharanpur Campus of IIT Roorkee. From the session 2007-08, a new 5 year Integrated dual degree programme B.Tech. (Process Engineering) and M.B.A. has been started at the Saharanpur Campus. Further, three new 5 year integrated M.Sc. programs and two new 5 year integrated M.Tech. (Science) and one 5 year integrated dual degree M.Tech. programmes were started in 2007 at the main campus. The institute has signed an MOU with the University of Western Ontario, Canada, under which selected students of 5 Years IDD programme of B.Tech. (Electrical Engg.) and M.Tech. (Power Electronics) can get training at UWO and on successful completion of course work and Dissertation at UWO in the 5th year obtain the degrees: B.Tech. (Electrical Engg.) from IIT Roorkee and M.E.Sc. in Computer Engineering from UWO.

IIT Roorkee has a highly qualified and motivated faculty of about 391 members which has a strong commitment to teaching and research. It offers its expertise to private and public sector industries, and various Government agencies through consultancy services. The Institute is playing a key role in the development of Uttarakhand State and the nation at large. Some of its ongoing major activities include: IT initiative for e-connectivity at community information centres under a UNDP funded project amounting to US $1 million: Manpower development in VLSI under a project from Ministry of Information Technology: Consultancy services to PWD Delhi for design of noise/dust barriers for flyovers as well as quality control of roads in Delhi: Conservation & management of Nainital Lake under Ministry of Environment and Forest, Government of India; Earthquake studies of multi-storied buildings in Peninsular India for their seismic performance and strong motion studies in Himalayas.

Each department has modern laboratories, well-equipped with sophisticated instruments which are essential for imparting quality education and training in engineering and technology. Some of the state-of-the-art facilities available include: 500 MHz NMR Spectrometer with cryoprobe, broadband probe, LC-NMR MS; Thermal ionization Mass Spectrometer (Triton T1 from Thermo Finnigan, U.K.) for high-resolution isotope ratio determination, X-ray diffractometer (Bruker Germany); Thermal Analysis System for TGA, DTA and DSC studies. The other sophisticated state-of-the-art facilities and laboratories at different departments are Climatology Laboratories, Protein Biochemistry and Analytical Biotechnological Laboratory, Process Dynamic Control Laboratory, Advanced Manufacturing Process Laboratory, Ultra Clean Laboratory for Geochronology isotope Geology, Corrosion Engineering Laboratory, VLSI Design Laboratory, Wind Tunnel, etc. A fully computerized satellite earth station and an automatic satellite data acquisition system have been installed at the Institute which can acquire data from more than 20 neighboring countries.

The Institute has spacious classrooms with multi-media facilities and a Central Library to cater to the needs of the students. The Central Library stocks about 300000 printed volumes of books, journals, and reports in various disciplines of engineering, technology, and sciences, and is a member of the Indian National Digital Library in Science and Technology (INDEST) Consortium. This membership provides online access to about 8000 e-journals. The library is accessible through its website http://library.iitr.ernet.in. Besides the Central Library, each department/centre has its own library.

Facilities

The Institute prepares its students to meet ever increasing technological and social challenges through its traditions of self-discipline, hard work, all-round personality development and innovative approach to problem solving. Situated on the banks of the Upper Ganga Canal, IIT Roorkee has a very green and peaceful campus spread over 365 acres at Roorkee and a 25 acres campus at Saharanpur. It is fully residential, with well-designed hostels (Bhawans) for both boys and girls, each having Internet facilities.

To promote the effective use of Information Technology, the Institute has established an Information Superhighway Centre in March 1996. The Centre manages a state-of-the-art Institute network with data, voice and video communication facilities. The network covers the entire 365 acres of campus connecting all Departments, Centres and hostels, thus providing Intranet and Internet connectivity to students, faculty and other staff members. The Centre also maintains the Institute website and various online web based utilities to facilitate the user community on the campus.

A separate state-of-the-art campus-wide networking has been done at the Saharanpur Campus. The Saharanpur Campus Network is linked to Roorkee Campus for easy access of general and scientific information between the two campuses. Connectivity through Wi-max and Wi-Fi is also being provided in the campus.

For all-round personality development, the Institute organizes several co-curricular activities such as THOMSO and RAVE, the annual youth festivals, COGNIZANCE, an all-India technical festival, and JIGYASA, a national-level paper presentation contest. Hobbies club and its annual exhibition SHRISTI are unique features of the Institute that promote creativity among students.

The Institute has sprawling sports grounds, a modern swimming pool, a boat club on Ganga Canal and a host of students clubs with Tennis, Squash, Badminton and Billiards facilities. Societies and Associations, along with activities like NSS, NCC, Rangering and Rovering, Mountaineering and Trekking provide excellent opportunities for self development.

There are two banks, namely SBI and PNB with ATM and Internet banking facilities, and a Computerized Railway Reservation counter on campus.

Credit System

The Institute follows modern methods of continuous evaluation through a credit system in all its UG, 5-year dual degree and PG programmes. The system offers flexibility to progress at a pace commensurate with the capabilities of a student, subject to minimum credit requirements. There is no annual/ semester pass or fail. The award system follows letter Grades on a 10-points scale where the performance is measured in terms of weighted grade point average (SGPA and CGPA). A student has to satisfy minimum CGPA and earned credit requirements to be eligible for the award of degree.

About Roorkee and Saharanpur

Roorkee is 30 km south of the Shivaliks and about 180 km north of Delhi. Roorkee is located on the Amritsar-Howrah

main railway line and is linked to Delhi through Shatabdi and Jan Shatabdi trains. It is also well connected by road being located on the Delhi-Hardwar-Mana National Highway (NH 58). Being 268 m above mean sea level, the town has a cold winter. Roorkee is an important centre of engineering activities in Northern India and several national institutes such as Central Building Research Institute (CBRI), National Institute of Hydrology (NIH), Irrigation Research Institute (IRI), Irrigation Design Organization (IDO) are located at Roorkee.

Saharanpur which hosts the satellite campus is about 50 km from Roorkee and about 150 km from Delhi. It is situated on Amritsar-Howarah, Delhi-Hardwar-Dehradun and Delhi-Meerut-Ambala-Amritsar main railway lines. It is also well connected by road to Delhi, Chandigarh, Amritsar, Hardwar and Dehradun. Saharanpur is a hub of Pulp and Paper teaching, research and manufacturing.

Rules for Change of Branch

A student enrolled in any academic programme except B.Arch. through Joint Entrance Examination (JEE), is eligible for change of branch/programme at the end of first year provided that he/she satisfies the following criteria:

1. Earned credits at the end of 1st year must be at least 48, and CGPA must be at least 6.5 for SC/ST category, at least 7.5 for other categories. The credits for NCC/ NSS/NSO/Rangering, proficiency and discipline shall not be counted for the calculation of CGPA and earned credits for this purpose.
2. While making the change of branch of a student, the strength of a class should not fall below the existing strength by more than 10% and should not exceed the sanctioned strength by more than 5%. For this purpose, the strength refers to the total strength of the students in the class of a given branch excluding the direct admissions and failures.
3. A student who has secured a rank within the top 1% and satisfies the criteria for eligibility of change of branch shall be allowed change of branch to his/her choice without any constraint if he/she applies for it. The remaining eligible applicants shall be allowed change of branch strictly on the basis of inter-se-merit as reflected in their CGPA. In case the CGPA of more than one student seeking change of branch is same, their inter-se-merit shall be decided on the basis of their ranks in JEE provided that a student of general category shall not be allowed change of branch/ programme against the vacant seats of SC/ST category.
4. If a student with higher CGPA is not offered a particular branch because of other constraints, this will not be offered to any other student with a lower CGPA even if he/she is eligible for change of branch on the basis of regulations above.

2.16 INSTITUTE OF TECHNOLOGY, BANARAS HINDU UNIVERSITY, VARANASI

The Institute of Technology is an integral part of the Banaras Hindu University – which has been an internationally established renowned seat of learning.

The University

Banaras Hindu University was founded in the year 1916 by the great visionary and patriot, Mahamana Pandit Madan Mohan Malaviya Ji. The University is situated in a magnificent campus spread over nearly 1300 acres at the southern end of the ancient city of Varanasi on the banks of the holy river Ganga.

The University has “within the same campus” three pioneering Institutes, viz. the Institute of Technology, the Institute of Medical Sciences and the Institute of Agricultural Sciences, and fifteen Faculties. This residential University has teaching and research facilities in over 135 diverse disciplines including Ancient History, Oriental Learning, Performing and Fine Arts, Management, Science, Social Sciences, etc.

Engineering Education

Engineering Education in Banaras Hindu University commenced as early as in 1919 with the establishment of Banaras Engineering College (BENCO). The University has also pioneered engineering education by being the first in the country to start degree courses in Mining, Metallurgy, Ceramic Engineering and Pharma-ceutics with the establishment of the College of Mining and Metallurgy and the College of Technology in the years 1923 and 1932 respectively. In 1969 these three colleges were amalgamated to form the Institute of Technology.

The Institute of Technology offers 4-Years B.Tech./B.Pharm. degree programme(UGD), 2-Years M.Tech./M.Pharm. degree programme (PGD), 5-Years Integrated B.Tech.-M.Tech./ B.Pharm.-M.Pharm. dual degree programme(IDD), 5-Years Integrated M.Tech. degree programmes (IMD) and Ph.D. programmes. The Institute has a highly qualified and motivated faculty of over 265 teachers. Besides teaching, the faculty members are also engaged in research and consultancy. The students are also encouraged to do projects under the able guidance of the faculty members. The research and development activities are supported by different National Agencies, viz. University Grants Commission, All India Council for Technical Education, Department of Science and Technology, Council of Scientific and Industrial Research, Defence Research and Development Organization, through programmes such as SAP, COSIST and FIST, and sponsored research projects, etc. The Institute of Technology consists of nine Engineering Departments (Ceramic Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Electronics Engineering, Mechanical

Engineering, Metallurgical Engineering, and Mining Engineering), a Department of Pharmaceutics, three Applied Sciences Departments (Applied Chemistry, Applied Mathematics and Applied Physics), and three Interdisciplinary Schools (Biochemical Engineering, Biomedical Engineering and Materials Science and Technology).

Academic Programmes

The Institute has well equipped laboratories and workshops, excellent computer facilities in all departments/schools in addition to a Central Computer Centre. The Institute has one Main Library along with many Departmental Libraries. These libraries house more than 200,000 books and subscribe to a large number of scientific and technical journals. Online access of these journals is also possible. All the students are provided with textbook bank facilities where a certain number of books are issued to them for full semester.

IT-BHU follows the semester system. An academic year (July-May) consists of two semesters each of approximately 20 weeks duration. The odd semester begins in the third week of July and ends in the first week of December. The even semester starts in the third week of December and ends in the first week of May.

Each theory and laboratory course has a certain number of credits assigned to it depending on its lecture and laboratory contact hours in a week. Each course is coordinated by a Coordination Committee, which has full responsibility for coordinating the course, holding the tests and awarding grades. A seven-point letter grade (with specified number of grade points) is awarded in each course for which a student is registered. A student's performance is measured by the number of credits that he/she has earned and also by the weighted grade point average earned by him/her for a semester/year/course.

Financial Assistance/Scholarships

Large numbers of scholarships are awarded to the undergraduate students. Merit-cum-Means Scholarship is awarded to 25% of the students in each class of each branch. There are a large number of Endowment Scholarships which are awarded to specified categories of students in different branches. The Institute of Technology, BHU is also one of the recognized institutions for award of scholarship to SC/ST students under Central Section Scholarship Scheme of top class education scheme of Ministry of Social Justice and Empowerment and Ministry of Tribal Offices.

Training and Placement

Training and Placement Cell of the Institute is actively involved in arranging in-campus placement of students in various industries and organizations and also arranges summer practical training which is an essential component of academic curricula. This cell also organizing soft skill development programme and gives pre placement training on various aspects.

The placement record of the Institute has been excellent and the job offers are approx 180% for each students. These job offers mostly comes from organizations like Microsoft, Hindustan Unilever, De Shaw, NTPC, Deloitte, Morgan Stanley, BHEL, GAIL, Goldman Sachs, Indian Oil, Bharat Petroleum, DRDO, Tata Motors, etc.

The alumni of the Institute are in the apex seat of esteemed organizations/institutions in India and abroad. Large number of students are also opting for higher studies in reputed universities all over the world. The students who have aptitude for management are qualifying for management programmes in IIMs.

The industry oriented summer internship programme is aimed at inculcating professional culture amongst the students and familiarize them in the work environment in the industry. The students are also encouraged to opt for summer internship in industrial/R&D/reputed educational institutions in foreign countries.

Hostels and Health Care

The Institute has nine hostels for boys and two for girls. All the hostels are equipped with modern amenities. The messes are very well managed by students and wardens. The students of the Institute are normally provided with single seated accommodation from second year onwards. There is an Institute Cafeteria, which runs during working hours. The health problems of the students are looked after by Students Health Care Complex. For specialized treatments, the consultation of senior specialists is available from the renowned Sir Sunder Lal Hospital attached to the Institute of Medical Sciences of the University.

Personality Development

The analytical, creative and managerial skills of the students get a chance to flourish through activities of the vibrant Institute Gymkhana, which has cultural, sports & games, and co-curricular wings. The Institute has full-fledged cricket and football grounds, and also volleyball, basketball and lawn tennis courts. All the hostels have facilities for indoor games and entertainment. Apart from these, all students of the Institute enjoy the privilege of a swimming pool, a gymnasium with lateral facilities and indoor stadiums. Gymkhana activities, mainly managed by the students, encourage artistic and creative talents in dramatics, elocution, music and visual arts. Gymkhana has various active clubs, viz. HAM, Audio, Photography, Automobile and Aero-modelling, Cine, Computer, Astronomy, etc. Students actively take part in managing three national level events every year, viz. All India Cultural Festival "KASHI-YATRA", All India Sports Competition "SPARDHA", and All India Exhibition of Engineering and Technology Models "TECHNEX".

Rules for Change of Branch

1. A student enrolled in an UG Degree/IDD/IMD programme through JEE, shall be eligible for change of branch/programme at the end of Part-I (First Year) provided he/she has scored YGPA $\geq$ 8.0 & satisfies the following criteria:

2. While making the change of branch of a student, the number of students in a class should not fall below the existing number of students by more than 10% and should not exceed the sanctioned number of students by more than 10%. For this purpose the existing number of students refers to the total number of students in the class of a given branch registered in the beginning of the third semester excluding the failures and re-admission cases.

3. The change of branch of UGD, IDD or IMD students will be within their respective programmes only.

4. A student admitted to UGD/IDD programmes in Pharmaceutics shall not be permitted change of branch.

2.17 INDIAN SCHOOL OF MINES, DHANBAD

Indian School of Mines (ISM) was established by the Government of India in 1926 on the pattern of Royal School of Mines, London to teach Mining Engineering and Applied Geology and thus to provide manpower to the Indian Mineral Industry and the concerned departments of the Government. Subsequently in 1957, Petroleum Engineering and Applied Geophysics disciplines were also added. In due recognition of its vital role in the service of the mineral exploration and mining sectors of the national economy, ISM was granted autonomy by the Government of India in 1967; and has been functioning as a Deemed University under the University Grants Commission Act, 1956. In 1996, it came under financial and administrative control of MHRD, Government of India. It has 218 acres of fully residential campus of its own consisting of graceful blend of old and new style buildings. The serene campus comprises academic buildings, separate hostels for boys and girls, faculty & staff quarters, health centre, workshop, canteen and other infrastructural facilities for its cosmopolitan community.

The school is situated about 3 km north of Dhanbad Railway Station on the Grand Chord of Eastern Railway. ISM being situated at the core of the industrial base of the region covering mines, steel plants, fertilizer plants, refractories, heavy machine building plants etc derives locational advantage in learning and teaching process in terms of keeping abreast with changing technology in the industry.

Departments and Academic Programmes

ISM offers B.Tech programmes in 9 disciplines, viz. Mining Engineering, Petroleum Engineering, Mining Machinery Engineering, Mineral Engineering, Computer Science & Engineering, Electronics Engineering, Mechanical Engineering, Electrical Engineering and Environmental Engineering; five year integrated dual degree programmes in Mining Engineering, Mining Engineering with MBA, Petroleum Engineering with Petroleum Management, Mineral Engineering with Mineral Resource Management and Mineral Engineering with Materials Technology.

It also offers five year integrated MSc programmes in Applied Physics, Chemistry, and Mathematics & Computing and five year integrated MSc Tech programmes in Applied Geology and Applied Geophysics.

ISM has been offering, since 1972, a number of industry-oriented M.Tech and M. Phil Programmes. The Ph.D Programmes in Engineering and Sciences also attract many postgraduate students from across the country.

The School also offers 3 year M.Sc Tech Programmes in Applied Geology and Applied Geophysics, 2 year M.Sc Programmes in Applied Geology, Applied Physics, Chemistry and Mathematics & Computing, through a separate All India Competitive Examination. A 2 year M.B.A. Programme is also offered where the admission is based on combined scores of CAT and personal interview/ group discussion of candidates.

Department of Mining Engineering has been granted the status of Centre for Advance Studies (CAS) in Mine Safety and Management and also a Quality Improvement Programme (QIP) Centre for higher studies (M.Tech and Ph.D) by University Grant Commission.

Laboratories

ISM can boast of a large number of well equipped state-of-the-art laboratories in various departments such as Rock Mechanics, Rock Excavation, Mine Surveying, Mine Environment and Safety Engineering, Computer Aided Mine Planning & Design Laboratories in the Department of Mining Engineering; Thermal, Steam Power, Theory of Machines, CAD, Oil Hydraulics, Strength of Material, Fluid Power, Fluid Mechanics, Material Handling, Mining Machninery, Drilling Engineering Laboratories in the Department of Mechanical Engineering and Mining Machinery Engineering; Paleomagnetism, Gravity and Field Testing, Electromagnetic Models, Seismic, D.C Resistivity, Instrumentation Laboratories in the Department of Applied Geophysics; Rock Cutting, Ore Geology, Engineering Geology, Photo Geology, Geochemistry, Coal Geology and Sedimentology, Petrology, Geohydrology Laboratories in the Department of Applied Geology; Mineral Characterisation, Communi-tion & Classification, Gravity Separation, Magnetic & Electrostatic Separation, Pyroprocessing, Fuel Technology, Bio-mineral Processing Laboratories in the Department of Fuel and Mineral Engineering; Perophysics, Drilling Fluids, Reservoir Fluids, Reservoir Engineering, Crude Oil and Product Testing and Petroleum Engineering Laboratories in the Department of Petroleum Engineering to name a few.

An extensive Geological Museum, a Seismological Observatory, an Experimental-cum-Training mine at No. 26 incline Godhur Colliery of BCCL, and Longwall Training Gallery are unique instructional facilities in Asia.

Computing and Internet facility

ISM has a state-of-the-art Computer Centre which supports campus wide Fiber Optic Network comprising of 2500 nodes that connect all the academic departments, central library, administrative departments, each room of hostels, residences of faculties and officers. Internet access is provided to all the users through two dedicated internet links of 30 Mbps and 8 Mbps from different ISPs.

Computer Centre has a number of state-of-the-art servers, LINUX and WINDOWS Labs and application softwares.

Central Library

The Central Library of the School has rich collection of books, journals, conference proceedings, standards, reports, theses and dissertations on all branches of engineering, applied sciences, earth science, social science, environmental science and management. The library provides access to nearly 100, 000 books, 250 current and 33, 500 bound volumes of journals, more than 8000 theses and dissertations and many conference proceedings, national newspapers and current magazines.

Different sections and services of library are automated with help of an Integrated Library Management Software called “LIBSYS”. All records of the library are accessible on Web based Online Public Access Catalogue (WEBOPAC) popularly known as internet catalogue, on the ISM campus wide network as well as through internet. It provides access to more than 14000 electronic journals.

The library has 4 servers, 20 PCs and other accessories adequate to cater to the needs of users. One information KIOSK and 4 PCs are meant for users to access OPAC data bases, e-books, e-journals and other e-resources. The reading areas in the library are WI-FI enabled.

Alumni Association

ISM is proud of its alumni. Traditionally, ISM alumni are holding top positions in industries and government offices. Graduates of this school are heading public and private sectors and also holding key positions in the area of academic and research both in India and abroad (USA, Canada, Australia etc). ISMAA is extremely active and vibrant in meeting its objective of enabling the alumni to keep in touch with the Alma mater, to promote and foster spirit-de-corps amongst the past and present students and the teachers of the School and to contribute towards furtherance of science and technology through its seven national and one international chapters located respectively in Bhubaneshwar, Dhanbad, Delhi, Ranchi, Kolkata, Mumbai, Nagpur, and North America.

Training and Placement

The training and placement cell of the School, headed by a Professor, maintains active association and excellent contacts with industries and the corporate sectors to secure jobs in various organizations of the country and abroad. The placement cell coordinates the placement activities to match the needs of the industry with the aspirations of the students.

R&D Activities and Technical Collaboration

ISM, in its various departments, is currently doing R&D projects worth more than rupees hundred millions sponsored by various Government Organisations namely, UGC, CIL, AICTE, MHRD, DST, SAC (ISRO), CSIR etc. The School has signed MOU for technical collaboration with CSIR laboratory, McNally Bharat Engineering. Co. Ltd, MTI (SAIL), Dept. of Atomic Energy, GOI, BHP Billiton (Australia), Bosch Rexroth AG Germany, Politecnico Torino, Italy etc.

The School enjoys seven posts of Chair Professors in different departments instituted by National Mineral Development Corporation, Steel Authority of India Limited, Tata Steel, Coal India Limited, (two) Uranium Corporation India Limited and Oil and Natural Gas Corporation.

Medical Facility

Medical facilities as available at health centre of the School are provided to all students during their period of study at ISM. The Health Centre is well staffed and equipped with facilities for treatment of outdoor patients. The services of specialized visiting doctors are also available on regular basis. Important hospitals in the country have been tied up for providing medical assistance and treatment in emergency.

Games and Sports

The School has unique infrastructural facilities on campus for indoor/ outdoor games and sports. The upper and lower grounds constitute beautiful arena for outdoor games and annual sports. The Sports Complex comprises infrastructure for tennis, basketball, volleyball, and badminton. A central gymnasium equipped with modern apparatus and Yoga Centre provide ample facility for building and toning up of physical and mental health. Srijan, the biggest techno-cultural-management festival of Eastern India is organized by ISS body of students every year which draws nationwide participation from different institutes. A number of student societies and hobby clubs functioning on ISM campus are the potential avenues to unleash students’ creativity and imagination in constructive events.

Financial Assistance/Scholarships

ISM provides financial assistance/ scholarships to a large number of students covering almost 40% of the student strength. Under ISM merit-cum-means scholarship, the institute provides scholarships to 25% of the students on role that includes tuition fee reimbursement in full apart from financial assistance @ Rs 800/- per month. Ten percent of the students on role are provided with only tuition fee reimbursement in full. All 5-Year Integrated M.Sc/M.Sc Tech students selected through IIT JEE are given DST Inspire Scholarships @ Rs.80,000 per annum. All M.Sc Tech students of Applied Geology and Applied Geophysics are given scholarship @ Rs 1000/- per month in their III year.

Under New Central Sector Scholarship Scheme 10 students are provided every year free boarding and lodging apart from grant-in-aid of Rs 45000/- for purchase of computer.

Besides, there are a host of scholarships sponsored by different State Governments and public and private corporate sectors.

Rules for Change of Branch

Change of branch will be considered at the end of second semester, based on the performance in the first and second semester examinations. Interested students may submit such applications within three days after the start of new academic session.

Change of branch shall be permitted subject to the following terms and conditions.

1. Students must not have passed any semester through special examination or by repeating the semester.
2. Students must have obtained at least 7.5 GPA out of 10.0 considering both first and second semesters. For SC/ST and PD students average GPA requirement will be 6.5 and above. Change of branch will be made strictly as per merit. In case of tie, it will be resolved by considering the JEE Rank of the applicants.
3. While permitting change of branch, the strength of a class should not fall below the existing strength by more than 10% and should not go above the sanctioned strength.
4. It should be ensured that the strength of the class, post change, should not fall below 50% of the sanctioned strength.
5. Students who complete both first and second semesters in all respects and secure rank within top one percent of the successful students (without special examination or repeating 1st or 2nd semester) of the batch shall be allowed to change to the branch of their choice irrespective of conditions stipulated at serial 3 & 4 provided that by this change no branch should exceed the sanctioned strength by five percent. The eligibility criteria as stipulated at serial 1&2 will apply.

3. SCOPE AND DESCRIPTION OF COURSES

Excellent opportunities exist for preparation of a successful professional career in design, construction, manufacture, management, teaching and research in several branches of engineering and sciences at all the Institutes. Candidates should, however, carefully select the courses, taking into account their aptitude, talent and interest. Brief information on various courses available at these Institutes, arranged according to the course numbers given in **Table-1** is given below.

3.1 FOUR-YEAR B.TECH. COURSES

1. AEROSPACE ENGINEERING

The aerospace engineers are concerned with the design, analysis, construction, testing and operation of flight vehicles, including aircrafts, helicopters, rockets and spacecrafts. The course is based on the fundamentals of fluid dynamics, materials science, structural analysis, propulsion, aerospace design, automatic control and guidance, and development of computer software.

2. AGRICULTURAL AND FOOD ENGINEERING

With increase in growth and associated industrial potential, Indian agriculture has now been accorded the status of an industry. The course on Agricultural and Food Engineering aims at producing engineering graduates to meet the requirement of technical manpower in development of farm machines, land and water resources management, agricultural production and manufacture of processed food. In order to meet the present demand of agricultural and food industries, the course has been suitably modified to include specialized training in design, development, testing and selection of tractors and farm implements, irrigation, drainage and watershed management using Remote Sensing and GIS; information technology, processing of food, fodder and fibre, utilization of biomass, byproducts and wastes in the production of biochemicals, fuels, manure and non-conventional energy. The course provides ample flexibility to the students for acquiring expertise in any of the three major areas of specialization, namely, Farm Power and Machinery, Soil and Water Conservation Engineering, and Food Process Engineering.

3. BIOLOGICAL SCIENCES AND BIO-ENGINEERING

A new B.Tech. program in biological sciences and bioengineering (BSBE) at IIT Kanpur was started in 2004. The program provides a unique fusion of biology with other basic and engineering sciences. There is **no prerequisite of biology** at school level for admission in this program. The goal of this program is to prepare the students, both in theory and practice, for leadership in the globally competitive fields of Life Science, Pharmaceutical, Biotechnology industry, academia and research. The program has been developed to meet the increasing demand in these fields of industry and research. Students of this program would find unique opportunities of employment and research in the areas of biomedical engineering, drug design, bioinformatics, biotechnology, nano-biotechnology, genomics etc. The course is designed to introduce biology as an experimental science, in contrast to its commonly perceived notion as a descriptive subject. The students will also find the application of a wide range of techniques in physical, chemical and mathematical sciences for designing, executing and interpreting experiments in biology.

The students of BSBE will take courses common with all other branches of science and engineering in the first year. During their second year, they will take foundation and elective courses in basic biology and bioengineering topics, besides developing their interest and excitement in biological experimentations and discoveries. Concepts in biology will be developed to provide a holistic view and to facilitate integration of these concepts with the fundamental principles of physics, chemistry, mathematics and engineering.

The final two years of the program will be dedicated to the development of the professional competence of the students on a broad spectrum of topics. These include structural and computational biology, biomaterials, downstream processing, bioengineer-ing and genomics etc.

Major emphasis during the final semesters will be on research and development and focus will be on development of entrepreneurial skill. Students would also compete for 'Joy Gill Endowment" scholarship for R&D internship in Bio-pharma and Biotech industries besides participating in Bio-business plan competitions.

4. BIOTECHNOLOGY

Students in the Biotechnology Department at IIT Madras have the best of both worlds of Biological Sciences and Engineering. These students will be well-grounded in the fundamental principles of Bioprocess Engineering and Biological Sciences, and will gain sufficient valuable experience in hands-on understanding of the various engineering units as well as state-of-the-art experiments in Biotechnology. The department provides an ideal milieu for inter-disciplinary collaborative work, with a focus on Healthcare and Bioprocesses, which will significantly benefit the students.

The course curriculum is designed to provide training in basic sciences, engineering sciences, mathematics and computing in the first two semesters, followed by foundation courses in Biotechnology and Chemical Engineering. Students get an opportunity to undergo summer training in industries or other academic institutions at the end of three years. The focus in the final semester is a project. The core courses include theory and laboratory courses in biological sciences such as Biochemistry, Microbiology, Genetics, Molecular Biology, Cell Biology, Genetic Engineering, Structural Biology, Immunology, Bioinformatics, and Computational Biology. The core theory and laboratory courses to impart the fundamentals in Chemical and Bioprocess Engineering include Material and Energy Balances, Biochemical Thermodynamics, Transport Processes, Bio-process Principles, and Downstream Processing.

Given the fast growing Biotechnology industry in India, this program trains graduates to be successful in challenging careers in the areas of Biopharma, Bioprocesses, Bioinformatics, and more importantly, Healthcare Biotechnology. The training also provides an excellent preparation for students who wish to do higher studies.

The Department of Biotechnology at IIT Guwahati offers a wide range of elective courses on various specialized topics such as Gene therapy, Food Biotechnology, Functional Genomics, Metabolic Engineering and so on. Students can also opt for relevant elective courses from other departments. The laboratories in the department are equipped with state of the art facilities for teaching and research in Biochemistry, Microbiology, Plant Biotechnology, Molecular Biology, Biochemical Engineering and Computational Biology.

The Department of Biotechnology at IIT Roorkee has well equipped laboratories for teaching and research in various areas of Biotechnology. The curriculum has been designed with Core Courses in Biological Sciences and Engineering and a number of Elective courses in broad areas of Microbial Biotechnology, Animal Biotechnology, Plant Biotechnology, Environment Biotechnology, Bio-chemical Engineering, Biomedical Engineering to prepare the students for career in Bioengineering.

5. BIOTECHNOLOGY AND BIOCHEMICAL ENGINEERING

This four-year B.Tech. programme in engineering (based on Modern Biology/Bioprocess Engineering) provides training in Natural, Biological, and Engineering sciences including relevant computer and management subjects. First year courses are common as in other engineering disciplines. A unique feature of the programme is the blending between life sciences and engineering.

Students get in-depth theoretical background/ practical training in various disciplines such as Genetics, Microbial Biotechnology, Plant Cell Culture, Agricultural Biotechnology, Cell Biology, Molecular Biology, Environmental Biotechnology, Immunology, Downstream Processing, Metabolic Engineering, Enzyme Technology, Protein Engineering, Bioinformatics, Intellectual Property Rights, etc. along with adequate laboratory classes. Basic process engineering subjects include Fluid Flow, Mass Transfer, Transport Processes, Biochemical Reaction Engineering, Instrumentation and Process Control, etc. Design of bioreactor and other bioprocess equipment is an integral part of the course.

Industrial training is compulsory for strengthening practical exposure of the students. Experimental/ design projects in the final year, on frontier areas of Biotechnology, help students to conceive industrial R&D related problems.

Students are encouraged to undertake industry oriented projects in order to win an assistantship of Rs. 50,000 in their sixth to eight semesters. Currently, projects under the Institute Mission Mode Programme on Molecular Biotechnology are given priority.

6. CERAMIC ENGINEERING

Ceramic Engineering is traditionally the oldest branch of Engineering practiced for thousands of years. It involves processing and manufacturing of all inorganic solid materials. Traditional ceramic areas are (1) Pottery and Heavy Clay ware, which include table wares, sanitary wares, decorative wares and tiles, (2) Cement, concrete and building materials, (3) Refractories, in the form of bricks, blocks, monolithicsand castables, (4) Abrasives, for grinding and polishing operations, and (5) Glasses such as window, architectural and decorative glasses, laboratory and kitchen wares, bottles for industrial and pharmaceutical packaging, lenses for equipment and ophthalmic uses and fibers as reinforcement materials. During twentieth century many new glass and ceramic materials, known as advanced ceramics, have been developed for a large number of engineering applications. The advanced ceramic materials processed by the use of synthetic raw materials are required for making large number of electronics devices; e.g. capacitors, magnets and magnetic recording materials, computer binary chips, piezoelectric and pyroelectric sensors, solid state lasers, optical fibers for communication, electro-optic devices, humidity and gas sensors, and solid state batteries. High strength toughened ceramics are used in aerospace, turbine, auto-mobile, and cutting tool applications. The field of bio-ceramics has picked up immensely in the last two decades due to its applications as implant materials and as bonding materials to soft as well as hard tissues. Similarly nanoceramic technology is another area for future generation devices with novel properties.

The four-year B.Tech course structure is designed to train the students for developing expertise in the processing, manufacturing and applications of different class of ceramic materials and products. The graduates are in great demand for various ceramic and glass industries besides Steel, Non ferrous metallurgy (e.g. Aluminum, Copper, Zinc etc), Cement and Fertilizer Industries. The graduates are also selected as

software engineers and management trainees. Some of the graduates proceed for higher studies to Institutions in India and abroad.

7. CHEMICAL ENGINEERING

Chemical engineers work in diverse fields like petroleum refining, fertilizer technology, processing of food and agricultural products, synthetic food, petrochemicals, synthetic fibres, coal and mineral based industries, and prevention and control of environmental pollution. Chemical engineering is concerned with the development and improvement of processes, design, construction, operation, management and safety of the plants for these processes and research in these areas.

8. CHEMICAL SCIENCE AND TECHNOLOGY

A four year B.Tech programme in Chemical Science and Technology, the first of its kind in the IIT system, is being offered by the Department of Chemistry at IIT Guwahati from the year 2008. This programme will prepare the students for the emerging need of qualified persons with adequate knowledge in both Chemistry and its technology related issues, in both academics and industry. It will also provide students practical training in basic science and engineering. The technological course components include applied catalysis, drug design, medicinal chemistry, nanomaterials and nano-science, fine and bulk chemicals, green chemical and technological practices. During the course, the students will be trained to do frontline research in interdisciplinary areas, which include materials science, environmental science and molecular biology. Graduates will have diverse job opportunities in the chemical industry, in pharma companies, in Biotech companies, in environment related businesses, and in R&D organisations.

9. CIVIL ENGINEERING

A civil engineer is concerned with planning, analysis, design, construction and maintenance of a variety of facilities such as buildings, highways and railways, airports, waterways and canals, dams and power houses, water treatment and waste water disposal systems, environmental quality control, docks and harbours, bridges and tunnels. A civil engineer is also required to deal with critical problems of today such as disaster mitigation and management, constructing offshore structures for oil production, flood forecasting and flood control, traffic congestion, transportation planning, use of non-conventional energy resources, for example, wind, tides, waves, etc. The breadth and diversity of the civil engineering profession make it particularly attractive. Computer Aided Design (CAD) and software development for various civil engineering facilities have become integral parts of civil engineering profession.

10. COMPUTER SCIENCE AND ENGINEERING

The course is concerned with theoretical and engineering aspects of Computer Architecture, System and Application Software, Computer Networks, VLSI, Internet Technology and Applications. Adequate emphasis is also given to Programming, Algorithm Design and Analysis, Formal Languages and Automata Theory, and Theoretical Computer Science.

11. ELECTRICAL ENGINEERING

These courses pertain to the broad disciplines of electrical power engineering and electronics engineering. An electrical engineer is concerned with the generation, distribution and use of electrical power, power control and instrumentation applications. An electronics engineer deals with the application of electronics in the processing of information in the fields of communication and control systems, electronic computers, industrial electronics and instrumentation. The specializations at six IITs, IT-BHU, Varanasi and ISM Dhanbad offering this course are listed below.

12. ELECTRICAL ENGINEERING (POWER)

The course pertains to the broad areas of generation, transmission, distribution and utilization of electrical energy. Apart from the relevant basic and engineering science courses, students are taught the fundamental courses of electrical, electronics, communication and computer engineering with orientation towards electrical power and energy systems. This is achieved through compulsory and elective courses in relevant areas which cater to the needs of power industry. The courses in these areas include Electrical Machines, Power Systems, Power Electronics, Drives, Computer Applications, Energy Efficiency and Conversion, Renewable Energy, Control and Instrumentation, HVDC, Signal Processing, etc.

13. ELECTRONICS ENGINEERING

The course provides a sound foundation in Electronic Devices, Circuits and Systems, Microelectronics and CAD, Electrical and Optical Communications, Signal/Image Processing, Control, Microwaves, Fibre Optics, Computer Hardware, Software and CAD. Vision. The programme is based on essential core and elective subjects which provide the flexibility necessary for a student to choose his/her field of interest.

Students are required to take up projects relevant to their specialization in the final year. The course is well designed for the students who intend to pursue higher studies in any branch of electronics, communication and computer engineering. Excellent employment opportunities exist in public and private enterprises and also in R&D organizations.

14. ELECTRONICS AND COMMUNICATION ENGINEERING

The course provides a sound foundation in Electronic Devices, Circuits and Systems, Microelectronics and CAD, Electrical and Optical Communications, Signal/Image Processing,

Control, Microwaves, Fibre Optics, Computer Hardware, Software Design and Computer Vision. This programme is based on essential core and elective subjects which provide the flexibility necessary for a student to concentrate on his/her particular interests, as well as for the department to introduce new topics as the subject expands. A substantial part of final year is devoted to a project of topical interest. The course is well designed for the students who intend to pursue higher studies in any branch of electronics and communication engineering.

15. ELECTRONICS AND ELECTRICAL COMMUNICATION ENGINEERING

The course is a judicious combination of core subjects and professional electives. The core subjects provide a sound foundation in areas like electronic devices, circuits, control, signals and networks, computers and communications, and electromagnetics. The foundation is strengthened by depth subjects in microelectronics, microwaves, communication, computers, digital signal processing, etc. The breadth subjects in Mathematics, Sciences, Humanities, Management, etc. widen the scope of the course. The course lays considerable emphasis on the laboratory classes. The course accommodates students' special interests through professional elective subjects in the areas of microelectronics and VLSI engineering, visual information processing and embedded systems, telecommunication systems engineering, RF and microwave engineering, Fibre Optics and light-wave engineering. New elective subjects are added from time to time to cater to the future technological needs. The curriculum also includes industrial training and intensive project work of topical interest. The curriculum makes a balance between excellent industrial prospects as well as higher studies in any branch of electronics and communication engineering.

16. ELECTRONICS AND ELECTRIAL ENGINEERING

A B.Tech. Programme in *Electronics and Electrical Engineering* (EEE) has wide scope with growing application of electronics in electrical power generation, transmission, and distribution and drive systems. The programme aims at producing engineers with sound knowledge in Electrical Engineering and a strong background in Electronics. The pass-out graduate engineers will have scope to orient themselves to take up challenging jobs in the industries and engage themselves in research and development activities in the fields of Electronics and Electrical Engineering.

The EEE curriculum has a number of core Electronics course. These courses are aimed at developing adequate background in digital and analog electronics, microprocessors, embedded systems, communication and signal processing. The Electrical Engineering courses focus on electrical machines, measurement and instrumentation, control systems, power electronics and power systems analysis, operation and control. The laboratory courses are aimed at giving hands-on experience in electronic circuits, microprocessors and embedded systems, digital signal processors, control and instrumentation, electrical machines and power systems. The electives are designed keeping in view the important developments in Electronics and Electrical Engineering.

17. ENGINEERING PHYSICS

Ideas and discoveries in Physics have not only enhanced our understanding of the physical world but also provided the main driving force behind many of the recent technological advances. In order to understand and keep pace with these changes, and also to initiate and press through further advancements, an individual must have a strong grasp of the underlying fundamental principles. The Engineering Physics programme is challenging, with a curriculum designed to stretch the mind. It is intended for students with strong aptitude in science and mathematics, who wish to apply these fundamental subjects to technological problems without regard for the historical divisions among the disciplines. The programme helps in conceptual visualization of new frontiers in engineering and technology and their attainment for the benefit of mankind. It prepares the students for challenging careers in industry, R&D institutions, advanced studies in engineering, science and technology, as well as entrepreneurship in future developments. The Engineering Physics programme at IIT Bombay provides a broad education in theoretical and experimental aspects of modern physics with an orientation towards some of the skills that will be useful to technological applications. In addition to several core courses in physics, special topics will be covered by electives such as solid state electronics, materials science, and applied nuclear science.

The B.Tech. Programme in Engineering Physics at IIT Delhi stresses on the basic physics that underlies the most developments in engineering, and on the mathematical tools that are important to all engineers and scientists. This emphasis, combined with hands-on experience with modern computers, electronics, lasers and state-of-the-art equipment and technologies, and a practical training in industry, leads to an excellent preparation for a broad range of careers. The opportunities are available in the key areas of VLSI, Photonics, Data Storage and Recording media, Communication, Holography, Quantum Electronics and Optical Devices, Optical Computing, Information Technology, Lasers, Plasma Processing, Particle Beams, MHD, Fusion Devices, Space Science and Engineering, Environment Technologies, Biomedicine, Neural Networks, Nanotechnology, MEMS and so on.

Institute	Specializations in Electrical Engineering (Course 11)
IIT Bombay	Electronic Systems, Control and computing, Communication and Signal Processing, Microelectronics, Power Electronics and Power Systems
IIT Delhi	Computer Technology, Control Systems, Electronics and Communications, Power Machines
IIT Kanpur	Electives in 3rd and 4th years can be chosen from Power and Control Systems, Information Systems, Microwaves, and Photonics, Microelectronics, VLSI and Display Technology.
IIT Kharagpur	Electives in 3rd and 4th years can be chosen from areas like Power Systems, Control Systems, Electrical Machines, Power Electronics and Drives, Instrumentation, Computer Technology, Electronics, Signal and Image Processing, Data Communication, Biomedical Engineering, VLSI design
IIT Madras	Communication and Signal Processing, Microelectronics and VLSI Design, Power Systems and Power Electronics
IIT Roorkee	Electives in 3rd and 4th years can be chosen from areas like Power Systems, Control Systems, Electrical Machines, Power Electronics and Drives, Power Quality, Instrumentation, Systems Engineering, Microprocessors and Interfacing, Electronics, Digital Signal Processing, Computer Applications, Robotics, etc.
IT BHU	Electrical Machines, Power Systems, Control Systems, Instrumentation, Power Electronics and Systems Engineering
ISM Dhanbad	Elective in the 4th year can be chosen from areas like Power systems, Electrical Machines, Control Systems, Power Electronics, Communication Engineering, Instrumentation, and Computer Science

The B.Tech. programme in Engineering Physics at IIT Guwahati provides a strong theoretical and experimental foundation in physics as well as in key areas of applied physics and engineering. The programme has a fair distribution of courses in pure sciences, applied physics, humanities and social sciences, and engineering streams. Biophysics, analog and digital electronics, materials science, nano technology, computational techniques, measurement techniques, and photonics are some of the core courses taught in the programme. Elective courses would be chosen from a wide range of advanced topics in pure and applied physics, engineering and technology. Laboratory courses and a two-semester project work are designed to impart practical skills and hands-on experience on variety of experimental techniques.

This programme at IIT Madras encourages students to learn the fundamental aspects of frontier areas in Physics and Electrical Engineering. In addition to several core courses in Physics, Electrical Engineering and other engineering branches, special topics will be covered by elective courses such as Solid State Devices, Cryogenic Engineering, Materials Technology, Communications Engineering and Photonics. The academic curriculum provides excellent academic/ laboratory training in Digital Electronics, VLSI, Communication Systems, and experiments based on advanced principles of physics.

These programmes will be suitable for those students who intend to pursue higher studies in physics, or would like to take up advanced studies in engineering requiring a good grasp of physical principles or wish to branch out after graduation in industrial research and development programmes. Good employment opportunities for Engineering Physics graduates exist in universities and in research and development sections of national laboratories and industries.

18. ENVIRONMENTAL ENGINEERING

Industry worldwide is on the throes of tumultuous change contending with hydra-headed environment issues and norms. In order to cater skilled and trained Environmental Engineering graduates to the industry, ISM Dhanbad has conceptualized a four year B. Tech. Course in Environmental Engg.

During the first two semesters, the students will undergo the core courses in basic sciences and engineering subjects. From third semester onwards, the course will cover important subjects like Environmental Chemistry, Atmospheric Physics and Meteorology, Environmental Microbiology, Air and Noise Pollution, Industrial Waste Management, Geology for Environmental Engineering, Solid waste Management, Principles of Unit Operations and Process in Water and Wastewater Treatment, Instrumentation Methods for Environmental Analysis, Principles of Structural Engineering, Hazardous and Biomedical Waste Management, Hydrology and Geotechnology, Municipal Wastewater Engineering, Environmental Impact Assessment, Environmental Economics and Socio-economics and Rehabilitation Planning, Environmental Aspects of Mines, Advances Soil Mechanics, Environmental Audit and EMS, Risk Assessment and Disaster Management, Environ-mental Policies, Legislation, Issues, Treaties, Proto-cols and Conventions, Remote Sensing and GIS. A large number of elective subjects will also be taught as per the choice of the students to cater the industries like Petroleum, Chemicals, Metallurgy, Mining and allied Industries.

19. INDUSTRIAL ENGINEERING

Industrial Engineering is a backend support to the functional engineers. Industrial Engineers are the solution providers to

the corporate world both for manufacturing as well as service organizations. They design and develop work systems, production system, management systems, service systems, and Management Information Systems. They help the industry in achieving higher productivity and competitive advantage. They have great role to play in conservation of natural resources and enhancing the quality of life of human kind.

Department of Industrial Engineering and Management at IIT Kharagpur has the distinct credential to be the first department of its kind in India. The Department has continually restructured itself to cater to the needs of the Indian Industries. Over the years, the scope of industrial engineering has expanded. The state-of-the-art of industrial engineering and management encompasses fields of study such as: production and product system design, systems engineering, quality control and engineering, software engineering/ e-commerce, and ergonomics/ human factors engineering, supply chain management, and technology management.

This four-year B.Tech. programme in Industrial Engineering focuses on developing efficient and cost effective work systems and business processes leveraging on technology and management, and on industry-focused academic programs blending theory with prevailing best practices and real-life problem solving. For problem-solving, the course stresses on analytical modeling, simulation and computer applications.

Over the years, the discipline of Industrial Engineering, as being practiced at IIT Kharagpur, has attracted several reputed and well-established private and public sector companies for sponsored research and industrial consultancy where bright and enterprising B.Tech. students get an opportunity for nourishing their immense potential for career development. Moreover, the Department takes pride in having a highly dedicated, student-friendly group of faculty members with constantly updating international academic support base.

20. INSTRUMENTATION ENGINEERING

Instrumentation ensures better quality and increased productivity in industries. It is also used for diagnostics in health care, environmental pollution measurement and in all fields of advanced research and development. Instrumentation Engineering is a multidisciplinary program drawing on several disciplines: electrical, electronics, computer, chemical and mechanical engineering, material science and biomedical engineering. Flexibility in curriculum is provided through electives enabling the student to choose subjects to their own fascination and career objective. The main emphasis is on process instrumentation and control. Advanced tools and techniques like VLSI design, MEMS, signal and image processing, optoelectronics and intelligent instrumentation are also included.

21. MANUFACTURING SCIENCE & ENGG.

The Manufacturing Science and Engineering Programme is designed to create a specialized breed of engineers-cum-managers, who are expected to evolve, build and manage with global outlook, a new class of physically distributed enterprises. The programme first builds a solid background of manufacturing systems and processes, with exposure to basic courses in engineering design and thermal sciences. It covers subjects like quality control, CAD, CAM, AI, CIM, Robotics, etc. The students are also exposed to state-of-the-art developments in micro-mechanical systems and intelligent systems driven by continuous innovation in product and process technologies. The programme, with its fine blend of advanced manufacturing technologies and broad based IT and management skills, is ideal for students who wish to take up challenging careers in engineering management and innovative system entrepreneurship

22. MATERIALS AND METALLURGICAL ENGINEERING/ METALLURGICAL AND MATERIALS ENGINEERING

Advances in technology depend on the availability of high performance materials. The field of engineering materials has expanded enormously in the recent past and has encompassed a variety of materials such as ceramics, polymers, electrical and magnetic materials, glasses and composites, along with the traditionally important metals and alloys. Critical selection of such materials for advanced engineering applications in high technology areas such as space, energy, and communications, is of utmost importance. B.Tech. programme encompassing metallurgical engineering and materials science/engineering have been designed to train engineering graduates, who would be highly competent in meeting the emerging needs of India in advanced materials as well as in conventional metallurgical engineering. Comprehensive programmes of studies allow the student to grasp the fundamentals of metal extraction, characterization, processing and selection of engineering materials. A wide variety of electives available during the third and fourth years of study give an opportunity to the student to concentrate in an area of his/her choice.

23. MATHEMATICS AND COMPUTING

Modern scientific investigations and technological developments require sophisticated tools from mathematics. The B.Tech programme in Mathematics and Computing at IIT Guwahati, the first of its kind in the IIT system, provides a fusion of mathematics with Computer Science and Financial Engineering. The curriculum is designed to provide the students with in-depth theoretical background/practical training in computer science, numerical computing, and mathematical finance. Graduates of this programme are prepared for careers in software industries, financial institutions, investment banks, and government organizations or to pursue higher studies.

24. MECHANICAL ENGINEERING

Mechanical Engineering is concerned with the design, operation and maintenance of machines and their

components, mechanisms, machine tools, manufacturing systems and processes, components of thermal power systems including internal combustion engines and turbo machinery, solar energy, heat transfer, air-conditioning, refrigeration and industrial engineering including production planning and control. The students of mechanical engineering have an opportunity to study both the fundamentals and applied aspects of these areas.

25. METALLURGICAL ENGINEERING

A metallurgical engineer is concerned with the extraction of metals from ores, their refining and purification, and their fabrication into useful shapes by casting, joining and mechanical working. He/she is also concerned with the study of the physical and chemical properties of metals and their structure in relation to their properties, principles of formation of alloys and methods of improving their properties.

26. METALLURGICAL ENGINEERING AND MATERIAL SCIENCE

The field of engineering materials has expanded enormously in the recent past and has encompassed a variety of materials such as ceramics, polymers, electrical and magnetic materials, glasses and composites, along with the traditionally important metals and alloys. Critical selection of such materials for advanced engineering applications in high technology areas such as space, energy, and semi-conductors, is of utmost importance. B. Tech. programme encompassing metallurgical engineering and materials science has been designed to train engineering graduates, who would be highly competent in meeting the emerging needs of India in advanced materials as well as in conventional metallurgical engineering. The programme allows the students to grasp the fundamentals of extraction, characterization, processing, selection, and life assessment of engineering materials. A wide variety of elective courses available during the third and fourth years of study give an opportunity to the students to concentrate in area of their choice relevant to the emerging challenges and excitement to link with the technological needs of their disciplines.

27. MINERAL ENGINEERING

A four-year B.Tech. Programme in Mineral Engineering, the first of its kind in India, is being offered by ISM Dhanbad since 1984. This programme has a multi-faceted orientation with a fine blend of core subjects, professional courses and allied courses relevant to the discipline of Mineral Engineering.

During the first two years, the students undergo the core courses in basic sciences and basic engineering subjects including Engineering Drawing, Workshop Practice, etc. followed by professional courses in Mineral Processing, Coal Preparation and Fuel Technology. Besides these, important allied subjects like Ferrous and Non-ferrous Extractive Metallurgy, Agglomeration Modeling and Simulation, Computational Techniques, Materials Handling, Maintenance Engineering, Environmental aspects, Geology & Mining, are also offered. The students are familiarized with the application of classroom concepts in industrial circuits through visits to local washeries and various processing plants, intensive industrial training and all India educational tours.

28. MINING ENGINEERING

Mining Engineering, a 4-year B.Tech. programme at IIT Kharagpur, IT BHU Varanasi and ISM Dhanbad, is concerned with the production of minerals. The field of study exposes the students to aspects of planning, design, construction, mineral excavation, transportation, maintenance, safety, and management of mines. Courses in the first two years provide the students with essentials of science, basic engineering, computing, and information technology. In the subsequent years, a group of core and elective subjects including methods of mining, geomechanics, numerical methods, environmental engineering, industrial management, computer-aided mine planning, remote sensing and geographic information system (GIS) are taught to keep pace with the latest developments in mining technology and to meet the present demands of the industry.

29. MINING MACHINERY ENGINEERING

Engineering graduates in Mining Machinery are concerned with the selection, operation, maintenance and design of all types of the machinery used in the exploration and exploitation of minerals including heavy earth moving equipment. ISM Dhanbad is the only Institute in the country that produces mining machinery engineers.

During the first two years, the inputs are given in different areas of basic engineering like mechanical, electrical, electronics and computers. The next two years are utilized for in-depth practice-oriented studies of mining and allied equipment.

30. NAVAL ARCHITECTURE & OCEAN ENGG.

Ocean Engineering is an interdisciplinary field that is concerned with all aspects of exploration and exploitation of the resources of the oceans. Naval Architecture deals with design, construction and maintenance of ships. The programme also deals with other water borne vessels. Apart from the core programme in science and mathematics, well structured courses in fluid and solid mechanics, wave hydrodynamics, offshore structures, foundation and coastal engineering are taught. The programme also imparts good design and experimental skills. The courses in the advanced semesters lay emphasis on numerical modeling and CAD, with electives from many postgraduate courses. Excellent facilities exist for carrying out the final year project work on advanced design, and experimental as well as numerical analysis of ocean engineering systems including marine vehicles.

A wide variety of job opportunities are available to the graduates in companies dealing with offshore engineering, ship building and ship repair, Coastal and Port Engineering, shipping companies, classification societies, statutory bodies, Port Trusts, Coast Guard, the Indian Navy and consulting organizations. Because of the multidisciplinary nature of the programme, a large number of graduates find employment in allied engineering professions and management area also.

31. OCEAN ENGINEERING AND NAVAL ARCHITECTURE

Ocean Engineering provides solutions to needs of the society for exploration and utilization of the ocean, its coastlines, and its vast natural resources such as extraction of oil from offshore wells, minerals from the sea bed, biological resources like fish and other sea food. The subject of ocean engineering is concerned with various industrial activities of design and construction, building and maintenance, production, operation, and transportation of marine structures. Naval architecture is a major branch of ocean engineering, which deals with design, construction, and maintenance of ships and other water borne vessels. The discipline of ocean engineering not only includes insights from all branches of engineering but it also incorporates unique marine features. Marine Hydrodynamics, Water Wave Mechanics, Computer Aided Design and Manufacturing (CAD-CAM), Computational Methods in Marine Hydrodynamics and Structural Mechanics, Design of Ships and Marine Structures, Marine Construction and Welding, Coastal Engineering, Hydroelasticity, Port and Harbour Engineering, Coastal Zone Management, etc. have become an integral part of this engineering profession.

The employers of ocean engineers and naval architects are the various offshore industries, ship building and ship repair yards, shipping companies, classification societies, statutory bodies under the Ministry of Surface Transport, offshore consulting firms, coastal and dredging consulting firms, instrumentation and data analysis firms and institutions, drilling companies, seismic and hydrographic surveying companies, Indian Navy, DRDO laboratories, coast guards, port trust, environmental protection agencies, pollution control boards, and academic institutions. Due to multidisciplinary nature of Ocean Engineering & Naval Architecture, a large number of graduates find employment in allied engineering professions, management and information technology areas.

32. PETROLEUM ENGINEERING

ISM Dhanbad is the only recognized institute offering B.Tech. degree in Petroleum Engineering in India. Course structure was initially developed by representatives of ONGC, ISM, IOC and Ministry of Education, Government of India. The course is regularly updated to keep pace with developments in Petroleum Engineering the world over by a body comprising of industry representatives, academicians and research institutes.

A rich selection of scientific challenges awaits students in Petroleum Engineering. All students receive rigorous training in the basics of Petroleum Engineering, Petroleum Geology, Reservoir Engineering, Well Testing, Production Engineering, Drilling Engineering, Refining Engineering, Petrochemical Engineering, EOR Simulation, etc. Students benefit from courses, seminars and interaction with fellow students and faculty of the associated department of Geophysical and Geological Sciences, and other Institutes, e.g. CMRI, CFRI, PDIL, ONGC, OIL, IOC & PCRA. Academic training imparted to the students is supplemented by appropriate oil field training of fourteen weeks during their degree programme.

33. PRODUCTION AND INDUSTRIAL ENGINEERING

Production and Industrial Engineering aim at higher productivity by integrating design and planning of operative systems. These engineers deal with planning, measuring and controlling all activities within the organization, besides optimum use of resources. Production and Industrial Engineering program forms a knowledge bridge between production activities and the management goals. The program covers major areas like manufacturing processes and automation, robotics, computer integrated manufacturing, cellular manufacturing, production planning, scheduling and inventory control, material requirement planning systems, operations research, quality management, man– machine systems and facilities design. Equipped with broad-base knowledge of the employment in all types of engineering and manufacturing systems, production and industrial engineers find their employment in all types of engineering and manufacturing industries both in the private and public sector.

34. PULP AND PAPER ENGINEERING

Pulp and Paper Engineering deals with the Science, Technology and Engineering used for the manufacture of pulp and paper products from fibrous and non-fibrous raw materials. The course is concerned with the characteristics of raw materials and pulp fibers, raw material storage, handling and preparation, various pulping and bleaching methodologies, processing of pulps, recovery of chemicals, preparation of stock waste, paper recycling and deinking, paper manufacturing including pressing, drying, calendaring, reeling, winding and roll finishing, sizing, coating and super calendaring, surface treatments, paper properties, testing and end-uses of pulp & paper, instrumentation and process control, energy, and environment. Pulp and Paper Engineering is also concerned with the design and development of processes, operation, maintenance and management of plants, basic economic consideration and cost control, research and development and other technical and marketing services related with the pulp and paper industry. The employment opportunities for engineers in this area have been excellent in previous years.

Pulp and Paper Engineering course is offered at Saharanpur Campus (50 km from Roorkee) of IIT Roorkee.

35. TEXTILE TECHNOLOGY

The UG program in Textile technology is primarily focused on the methods of developing textile products from natural fibres or from fibre forming polymers and on issues related to the management of the production facilities. Core textile courses cover topics on fibre science, yarn manufacture, fabric manufacture, textile chemical processing, textile testing and design of textile products and processes. Special courses are offered on thrust areas such as technical textiles encompassing topics on medical textiles, geotextiles, filter fabrics etc., flexible and rigid composites, smart textiles, nanoprocessing, apparel engineering and comfort as also environment management. From fifth semester onwards the students choose electives from a wide variety of textile courses and can specialize in a particular area of textile technology. In the final year they are required to work on a project on one of the thrust areas.They also undergo a practical training in a textile production facility as part of their engineering education.

3.2 FOUR-YEAR B.PHARM. COURSE

36. PHARMACEUTICS

The Department of pharmaceutics, IT-BHU is the first Department to offer B.Pharm. degree course first time in India since 1932. It is a unique course of its kind imparting knowledge on various aspects of design, development, testing, safe and effective uses of drugs and medicines including drug delivery systems. The program provides a unique fusion of biology with engineering and technological concepts to develop skilful process(es)/techniques for designing, procuring, and evaluating various kinds of drugs, drug delivery systems, and consumer products. The course thus provides a unique opportunity to pharmacy qualified professionals to serve the humanity by alleviating the discomfort, pain and sufferings (caused by various diseases) through discovery and development of safe and effective drugs and medicines.

In addition to the study of basic Sciences, Computer programming and Communication skills etc. at first year level, the course of other three years includes an in-depth study of both theory and practical aspects of various subjects like – Pharmaceutics, Pharmaceutical Technology, Pharmaceutical Engineering, Pharma-cokinetics, Pharmaceutical Management, Micro-biology, and Biotechnology, Pharmaceutical and Medicinal Chemistry, Pharmaceutical Biochemistry, Pharmacognosy and Tissue Culture, Pharmacology, and analysis/Assay of Drugs and Pharmaceuticals, etc. Educational Tour, Training in Pharmaceutical Industry, Seminars and Projects are also part of the curriculum.

Considering the fact that India is the fifth largest country in the world in terms of maximum consumption of pharmaceutical products, the pharmacy qualified professionals have tremendous opportunities to get jobs as managers and Executives in rapidly growing Bulk Drug and Pharmaceutical(more than 15 % annual growth worldwide every year), Biotechnological, Herbal, Neutraceutical, Cosmetic, Fast Moving, Consumer Goods(FMCG) and pharmacy need based Software Industries. Pharmacy Graduates and Postgraduates, also get employed in Analytical Testing Services Laboratories, Drug Control Administration(as Drug Controller/Assistant Drug Controller/ Drug Inspector), Drugs and Formulations Development and research & Development Laboratories of CSIR as well as privately funded Laboratories, Hospitals (As Clinical and Community Pharmacy Services), Drug Distribution through wholesale and retail chains of Pharmacy stores, Entrepreneurship in pharmacy and also in research and Teaching in Universities and Institutes offering such courses worldwide. The competent, skilled and knowledgeable pharmacy qualified graduates and postgraduates can get the above jobs not only in India but also abroad, (USA, Europe and other developed and developing countries).

3.3 FOUR-YEAR B.DES. COURSE

37. DESIGN

IIT Guwahati offers for the first time in the country a four-year undergraduate program in Design leading to B.Des. degree. This integrated design programme focuses on enhancing analytical and methodical approaches in creative problem solving covering the fields of Industrial Design – which includes products and product systems, and Communication Design – which includes all written, symbolic and visual information and materials.

The curriculum covers the subject domains influencing Design, including Technology, Human Factors Engineering, Aesthetics and Social Sciences.

The industrial designer is concerned with the design and innovation of new products through an understanding of how people use products, how industry manufactures them, and with their appearance, functionality, usability and safety.

Designers are trained to work in the areas of Graphic Design, Information Design, New Media, Interaction Design, Instruction Design, Exhibition Design, etc.

In the emerging competitive business environment, this new profession offers tremendous opportunities for professional work in various industries in the country and abroad. This program is recommended for candidates with flair for creative work and possessing aesthetics sensibilities.

During the first year of the four-year B.Des. Programme, the students develop their visualization and conceptualization skills and master the basics of design and model building. In the next two years, the program focuses on user-centric considerations in design where they further develop their

knowledge of the various aspects of technology, materials, human factors, and methods of problem solving. Computer application in design is an important thrust area in the program. Various projects that are undertaken by student provide hands-on experience of 'learning by doing'. During the final year, students undertake courses in the professional practice and management of design, alongside a major design project. To give them real life experience of working in a professional environment, the students are encouraged to take projects that meet requirements of industry or design firms. At the end of every academic year they are encouraged to undertake industrial training at different industries and design firms.

Design Graduates today have ample opportunities to work amongst leading industries that have their own design departments or to pursue higher studies in the fields of Design, Usability, Human Factors and Design Management. Product designers are placed in design departments amongst the leading companies that include automobile manufactures, the computer industry, the furniture industry, and consumer product industries. In the field of Communication Design, opportunities exist for designers to work in IT related areas of web design, information design, interaction design, and also in Consulting Design Firms engaged in the areas of packaging design, corporate identity design, exhibition design and print media design.

A majority of students who have graduated from the program in the previous years have opted for higher studies in design in leading universities abroad while the others have joined leading Indian industries.

The importance of the profession got recognition in the country when Corporate India instituted the first national design award, 'Business World-NID Award for Design Excellence' in June 2004.

The candidates desirous of joining this course will be required to qualify in Architecture/Design Aptitude Test to be conducted at any of the participating institutes. The test will be held in all institutes where counselling is done on **Thursday, June 10, 2010.** The test will be of three hours duration, from 10.00 am to 1.00 pm. Such candidates must have their JEE-2010 Admit Card with them to appear in the Aptitude Test. Candidates who fail to qualify in this Aptitude Test will not be eligible for admission to B.Des. courses. Syllabus for the test is given in **Section 4.2**.

3.4 FIVE-YEAR B.ARCH. COURSE

38. ARCHTICTURE

An Architect is a professional who designs buildings and built environments, and acts as the leading coordinator for the entire construction project from conception to completion. Architecture is the "art and science of building" – hence an Architect's education needs to be a perfect balance between art, science and technology. As an architecture student, one is encouraged to develop one's creative talents and artistic skills, as well as hone one's analytical aptitude for building science and technological innovation. The role and importance of an architect in society has been acknowledged since time immemorial, and assumes special significance in today's world when buildings and spaces serve complex and diverse functions and need expert monitoring and coordination during planning and construction.

Architectural education equips a student with basic design and visual arts skills, as well as a thorough knowledge of building materials, methods of construction, structural principles and innovations and other related technological aspects of building (like air conditioning, acoustics, illumination and intelligent systems). The student is also exposed to hard-core construction issues such as construction project management, professional practices, specification, estimation and arbitration. There is a strong emphasis on practical training, whereby the student works as a professional apprentice in an established architectural firm for almost the entire ninth semester. The final semester consists of a complete real-life architectural project handled single-handedly by the student which is a true simulation of entire scope of works, responsibilities and liabilities of a practicing architect. On completion of five years of education, the Council of Architecture (India) offers a professional license to the architect for independent practice in the profession.

The professional opportunities for a graduate architect are diverse. Apart from the option of independent practice or expert consultancy, an architect may gain employment in professional consulting or construction firms, private, public or government organizations, as well as pursue higher research and teaching careers. The avenues of higher studies and research open to a graduate architect are also wide ranging. The related research areas include urban design, interior design, landscape design, industrial product design, city and regional planning, transportation planning, environmental planning, heritage and conservation studies, sociological aspects of the human-built environment interface, digital art and visual communication, and computer applications (design software programming, decision support systems and artificial intelligence).

The candidates desirous of joining this course will be required to qualify in Architecture/Design Aptitude Test to be conducted at any of the participating institutes. The test will be held in all institutes where counselling is done on **Thursday, June 10, 2010.** The test will be of three hours duration, from 10.00 am to 1.00 pm. Such candidates must have their JEE-2010 Admit Card with them to appear in the Aptitude Test. Candidates who fail to qualify in this Aptitude Test will not be eligible for admission to B.Arch. courses. Syllabus for the test is given in **Section 4.2**.

3.5 FIVE-YEAR M.PHARM. DUAL DEGREE COURSE

39. PHARMACEUTICS

The M.Pharm. Dual Degree Course framed with a view to prepare the incumbent to cater to the current and future needs of advanced level aspects of pharmaceutical production, drug development, computer-aided production of various types of newer and targeted drug delivery systems, the design of process and product development techniques. This programme will expose the students to research methods currently being studied worldwide, with an emphasis on smooth transition from basic principles to actual handling of production design/production/quality assessment and feedback from the market. In the first six semesters the students will be studying basic courses in Pharmaceutical Chemistry, Physical Pharmaceutics, Pharmaceutical Technology, Pharmaceutical Analysis, Pharmaceutics Jurisprudence, Pharmaceutical Engineering, Pharmaceutical Biochemistry, Drug Activity in Biological Systems and Microbial aspects of genetically engineered drug molecules. Additionally, they will also be given elective courses (any one) in History of Science and Technology, IPR, Ethics, Energy Management, Industrial Psychology and Entrepreneurship Development. The semesters VII and VIII will be a combination of UG and PG courses in Formulation Design, Advanced Pharmaceutical Analysis, Advanced Pharmaceutical Medicinal Chemistry, Advanced Drug Delivery Systems, Pharmaceutics and Pharmacognosy. Semesters IX and X will be entirely devoted to PG courses, comprising advanced courses in Biopharmaceutics, Pharmacokinetics, Molecular and Clinical Pharmacology, Evaluation of Drugs, General Pharmacology, PG Seminars and Dissertation on selected topic. The courses have been designed with basic subjects in Pharmaceutical Sciences for the first six semesters, and the last four semesters are designed with a view to prepare the students for wide variety of research-oriented studies, which have a bearing to ongoing and futuristic programmes. The students, thus, will have an exposure to masters' courses, since such an exposure will eventually become necessary for an advanced level understanding of Pharmaceutical Sciences and Technology, leading to optimised user friendly therapeutic systems, and will prepare the students for excellent placement in the ever developing Pharmaceutical industry.

3.6 FIVE-YEAR M.Sc. INTEGRATED COURSES

40. APPLIED GEOLOGY

Ever since the Earth System originated, it has been evolving through a series of complex dynamic processes. Understanding and modeling these processes is quite challenging and exciting. These complex processes lead to picturesque landscapes; more importantly, they also result in local scale enrichment of various metallic, non-metallic, water and fuel resources that have been the backbone of the human civilization. On the flip side, Catastrophic events like earthquakes, volcanic eruptions, landslides represent the sinister side of these processes. Geology and Geophysics, the two sub-disciplines of Earth Science, have the common goals of understanding the origin of Earth vis-à-vis the solar system, of quantifying the Earth's evolutionary processes, searching for Earth Resources and predicting and mitigating natural and anthropogenic disasters and hazards. **Geology** primarily involves studying the Earth processes through direct sampling of earth materials like rocks, soils, water and vegetation in the field and devising sophisticated laboratory methods and tools for interpretation of results. The primary objective of **Geophysics** is to probe the inaccessible depths of the Earth for understanding its 'anatomy' on the basis of bulk physical (electrical, magnetic, electromagnetic, gravitational, elastic and visco-elastic) properties and phenomena, such as electrical, magnetic, electromagnetic and gravitational properties, and propagation of elastic waves through its interior. All this requires sophisticated instrumentation and rigorous mathematical tools.

The Department of Geology and Geophysics of IIT Kharagpur offers five-year integrated M.Sc. programs (unique in the country) in both the disciplines, imparting training on applied aspects of Earth Science.

Core courses in Applied Geology enable students to develop expertise in the study of minerals, rocks, fossils and ores. Students are imparted laboratory and field training (a total of 18 weeks of field work) under this program. Apart from disseminating information, emphasis is given to acquisition of basic tools for quantification of processes. Modern courses focusing on crust-mantle interaction, mountain building processes, global climatic changes, basin analysis, low-temperature Geochemistry, water-rock interaction, isotope Geology, mineralogical spectroscopy are devised to expose the students to frontier areas of research. Rigorous training on techniques and tools for exploration of earth resources is imparted through adequate exposure to courses such as Engineering Geology, Ground Water Geology, Remote Sensing & GIS, Environmental Geology and Micropaleontology, that have immediate industrial and environmental importance. The teaching in Applied Geology is backed up by excellent computational and laboratory facilities e.g. X-ray Fluorescence Spectrometer, Laser–Raman Probe, Total Organic Carbon Analyzer, a Gas source stable-isotope Mass Spectrometer, to name a few.

The curricula of M. Sc. in Applied Geology provide the opportunity of becoming specialized in the field of interest by taking appropriate courses in the fourth and final years. Students get ample opportunities to get them acquainted with modern research methodologies while working for their Masters' dissertation during the last two semesters. Exposures to industries and R & D activities are provided through summer training.

Students get excellent job opportunity in the Cement, Oil and Natural Gas and Mining sectors, and also Research

Laboratories. Our graduates excel in higher studies abroad, most of them being well placed in R&D sectors and Universities in the US, UK and other developed countries.

41. APPLIED MATHEMATICS

This programme has been designed to provide the students a rigorous training in Mathematical thinking through carefully designed curriculum structure and courses, the students will get to study various topics of Pure and Applied Mathematics along with getting the training in software tools which will equip them better to compete for GATE/NET and take research as a career. The programme will also enable the students to compete better in the job market in the software industry.

42. APPLIED PHYSICS

The course aims at nurturing students interested in carrying out advanced studies in Applied Physics – both theoretical and experimental. The stress will be application oriented in Engineering, technology, industry and medicine. A balanced and uniform course structure and syllabus has been drawn by the Department which include undergraduate core courses in basic sciences, engineering graphics, computers and workshop practices to be offered in the first two semesters of the ten-semester programme. Students will also be exposed to comprehensive courses in computers, computer graphics, humanities, social sciences, mathematics, chemistry, computational Seismo-logy, etc. apart from various courses in pure and Applied Physics. In addition, the students are required to undertake one of the engineering courses being offered currently by the various other departments of the Institute. They are also to take part in co-curricular activities in all the even semesters. Besides they will also be required to opt for three elective physics courses, deliver three seminars and take up two projects on experimental/ theoretical physics of contemporary importance.

43. CHEMISTRY

This programme prepares the students for modern day research in chemical sciences by providing them, besides an in-depth education in chemistry, adequate training in mathematics, physics, computers and engineering sciences. In the first two semesters of their stay in the programme, they take the same courses as their fellow engineering students. During the course, they are trained to do frontline research in interdisciplinary areas, which include materials science, environmental science and molecular biology, in addition to traditional topics in chemistry.

44. ECONOMICS

IIT Kanpur offers for the first time a unique five year integrated M.Sc. program in Economics. It was conceptualized with a need to combine training in technology related issues with economics. Currently many students with engineering degrees seek additional training in economics to make them more efficient professionals. Similarly many engineering and management consultancy firms find it necessary to attract professionals that are well versed in both technological and economical skills.

Contemporary developments in materials research, telecommunications, information technology, biotech-nology as well as the sustainable development of nonrenewable resources necessitate an interaction between economics and technology. Even, conventional service areas, such as banking and finance, have also undergone rapid and fundamental changes, both in terms of products and processes, due to the development of information technology and computational skills. Similarly commercialization of modern technology (from laboratory to the market) involves a whole gamut of patents, intellectual property rights, investment planning pricing contracts and so on. Therefore, a synthetic understanding of technology and economics will provide the students with an enduring expertise.

The program provides courses in basic science, engineering, and computational methods in the first two years. The rest of the program offers extensive training in economic theory, econometric and quantitative techniques, industrial economics, development trade, and infrastructure economics, environmental economics. The student will be able to take specialized courses in areas that interface with technology. For example, the areas covered will be economics of information technology, economics of biotechnology, economics of research and development, multinational enterprises, transport economics, water resources economics, health economics and health care policy, computational finance, environmental impact assessment, economics of regulation, economics of intellectual property rights, and law, technology and public policy. Every student who gets a M.Sc degree in Economics will have capabilities to identify real world problems as they emerge, articulate an appropriate mix of economic and technological solutions, and design policies to implement them instead of depending exclusively on known solutions.

Such students will be in great demand in international and national business and consultancy organizations, multinational corporations, firms dealing with information technology, banking and financial sectors, conventional government departments, and administrative services. They will also be in a position to compete with students from the best known foreign and Indian institutions in pursuing further research work.

IIT Kharagpur offers an excellent opportunity for exceptionally bright students to get admitted to a five year integrated M.Sc. programme in economics, a unique programme in IIT system. This holistic programme is being offered by the Department of Humanities and Social Sciences, which has a multi-disciplinary character, with the involvement of sister departments like Mathematics, Industrial Engineering and Management, Computer Science and Engineering, Architecture and Regional Planning, and

Vinod Gupta School of Management. The common programme in the first two semesters would make the students efficient in developing verbal and quantitative abilities with a scientific approach. Thereafter, students would be given a thorough and intense exposure to economic theory, analytical tools, mathematical techniques and applied econometric models with adequate stress on interpretations of the results along with their socio-economic implications. Theory classes will be supplemented by lab practices, projects, industrial training and seminars. The course would succeed in establishing a synergy between technology and economics to understand the real world situation more accurately and intensely.

Through a suitable choice of professional electives, students can specialize in selected streams like environmental economics, quantitative economics, business economics with provisions for super specialization in certain chosen fields under the streams. At the same time, ambitious and hard working students can earn a minor in areas like mathematics and computing, statistics, industrial engineering and management. The new breed of economists specially trained for problem solving purposes are expected to be in high demand in industry, institutions of higher learning and research, both at home and abroad, in the increasingly globalized world of tomorrow.

45. EXPLORATION GEOPHYSICS

The primary objective of Geophysics is to probe the inaccessible depths of the Earth for understanding its anatomy on the basis of bulk physical (electrical, magnetic, electromagnetic, gravitational, elastic and visco-elastic) properties and phenomena, and the propagation of elastic waves through its interior. All this requires sophisticated instrumentation and the application of rigorous mathematical techniques.

The Department of Geology and Geophysics at I.I.T. Kharagpur offers a 5-year integrated M.Sc. programme in **Exploration Geophysics**. This programme covers fundamental courses on Solid Earth Geophysics, Geophysical field Theory and Exploration Techniques with special emphasis on mathematical and computational tools. Electrical, Electromagnetic, Gravity and Seismic methods of exploration are covered in great details. Rigorous training in earthquake Seismology and Seismic Tomography, Geophysical Signal Processing, Nuclear Geophysics is an integral part of the curriculum in this programme. Students and Exploration Geophysics undergo rigorous field training that involves use of various equipment and acquisition of data in the field. State-of-the-art equipment in Geophysics include 48-Channel Reflection, Refraction and Engineering Seismograph, Broad Band Seismograph, Strong Motion Accelerographs, VLFEM, Gravimeter, Magnetometer Resistively Meter and radiation measurement equipment. A Global Seismological Observatory is commissioned in the department.

Students get ample opportunities to get themselves acquainted with modern research methodologies while working for their Masters' dissertation during the last two semesters. Exposures to Industries and R&D activities are provided through summer training.

Students get excellent job opportunities in the Cement, Oil & Natural Gas and Mining sectors, and also Research Laboratories. Our graduates excel in higher studies abroad, most of them being well placed in R&D sectors and Universities in US, UK and other developed countries.

46. MATHEMATICS AND COMPUTING

The 5-year integrated M.Sc. course in Mathematics and Computing course is designed to provide strong foundation in both mathematics and Computer Science. It attempts to integrate important topics of mathematics such as Numerical Analysis, Logic, Discrete Structures, Statistics and Operations Research with theory and practice in Computer Science and Software technology. The programme covers courses on fundamental mathematical topics such as Real and Functional Analysis, Topology Linear and Modern Algebra, Number Theory and Graph Theory. In addition to these, extensive theory and/or laboratory courses are included covering Numerical and Non-numerical Computing, Algorithms, Data Structure and file organization, Systems Programming, Compiler Design, Operating Systems, Data base systems, Computer simulation and logic programming. Courses like Object-oriented programming, Image and vision computing, computational geometry, Computer graphics; Symbolic computation, Artificial intelligence, Software design theory, Parallel algorithms, etc. are available as electives. Besides, the students have to complete three projects as part of the curriculum.

The students completing this course get lucrative placements in top notch software industries engaged in design, development and research. Many students also go for advanced level research career in Mathematics, Computer Science, Statistics, or Operations Research and subsequently join teaching/research positions in industry, government or academia.

47. MATHEMATICS AND SCIENTIFIC COMPUTING

The development of mathematics has always affected all human endeavors, including the computing technology. Today, the nature of mathematics and the way mathematicians think are also being affected significantly because of the fast changing trends in computing technology. Modern Mathematics has a significant computing component that is essential in vast areas of scientific and industrial activities.

This programme provides a rigorous training in mathematical thinking and the analytical capability needed in present-day scientific computing. Through a carefully designed sequence of compulsory and elective courses, the programme enables

a student to specialize in the area of his/her choice, be it pure mathematics, applied mathematics, statistics, or computing and development of mathematical software.

A graduate of this programme would have a broad based training in computational techniques, mathematical modeling, simulation, probabilistic and statistical tools, and will be equipped to make significant contributions in academic research/teaching, or to pursue a meaningful career in public/ private sector undertakings or in R&D organizations.

48. PHYSICS

This course is designed to produce students capable of pursuing advanced studies in theoretical and experimental physics as well as handling problems related to applications of physics in engineering, technology, industry and medicine. This is achieved by making use of a well-balanced course structure consisting of undergraduate core courses in basic sciences, engineering sciences, technical arts, and workshop practice. In addition, students are required to study courses in computer science, humanities and social sciences, etc. In the final years of the programme, the students can opt for specialized courses in advanced physics and they have to work for projects related to current problems in experimental and theoretical physics.

3.7 FIVE-YEAR BS and MS DUAL DEGREE COURSE

49. PHYSICS

A new five-year integrated Dual Degree, B.S. plus M.S. in Physics, has been introduced by IIT Madras. This special course is designed impart an exciting curriculum in the foundations and applications of Physics to students who would become distinguished scientists and/or leaders in the academic world or play a lead role in pure and applied research and development in interdisciplinary areas which requires a strong background in Physics. Students would get accelerated exposure to advanced principles and applications in a curriculum format that is carefully paced to make comprehensive learning an exciting and fulfilling experience. A strong research component in the final year will be a stimulating component of this program.

3.8 FIVE-YEAR M.SC. TECH INTEGRATED COURSE

50. APPLIED GEOLOGY

The Department of Applied Geology of ISM, Dhanbad is the pioneering centre of teaching and advanced research in “Applied Geology” in India. Established in 1926 with the fundamental objective, of education and training for professional careers in the field of Applied Geology, the trained graduates of the Department, by virtue of their high professional ability and skill, have always been in the mainstream of the Nation’s mineral exploration and development programmes. The Department hosts well-equipped laboratories and the state-of-art analytical facilities for training and advanced research in the field of Applied Geology. The laboratories of the other sister Departments (Applied Geophysics, Mining Engineering and Petroleum Engineering and Mineral Engineering) complement the facilities that make the courses of study in Applied Geology unique at ISM. (In addition to the specialized course of study, the Department is also engaged in providing industry based executive development programmes and consultancy services).

Considering the increasing demand of trained manpower in the field of Geology, the Department is reintroducing its 5-year integrated M.Sc. Programme in Applied Geology.

51. APPLIED GEOPHYSICS

This is a multi-disciplinary programme with inputs from Geology, Physics, Mathematics, Electronics and Computer Sciences. Basic and advanced papers on Exploration Geophysics with special emphasis on hydrocarbon exploration including exploration for gas hydrates and coal bed methane are taught. A significant part of the programme is devoted to Solid Earth Geophysics and Earthquake Seismology. The programme gives equal emphasis on each unit of exploration activity, viz, acquisition, processing and interpretation. Training in the filed constitutes an integral programme arranged by the Department with leading Oil and Mineral Industries besides its rigorous in-campus and field training activity organized by the Department.

The Department is actively engaged in R&D activities with major areas of research such as Exploration for Gas Hydrates and Coal Bed Methane, Magneto Telluric Studies, Geophysical Signal Processing, Earthquake Seismology, Petrophysics, Remote Sensing and Gravity Magnetic Studies.

Presently students with Applied Geophysics degree have excellent job opportunity with leading oil companies in India and abroad.

3.9 FIVE-YEAR M.TECH. INTEGRATED COURSES

52. GEOLOGICAL TECHNOLOGY

This course is intended to train the students in different aspects of the pure and applied aspects of Geology in an integrated manner. The emphasis of the course will be on Applied Geology. The main objective is to impart the latest technological advancements in the filed of Applied Geology. The training will focus on developing the capability to apply the knowledge in the exploration of natural resources. Following branches of Applied Geology will be given special attention: Petroleum Exploration, Remote Sensing and Geographic Information System, Ground Water Exploration,

Mineral Exploration, Engineering Geology, Natural Disaster Mitigation and Environmental Geology. A special feature of the course will be the training of the students in Geophysical Exploration and Well Logging. Some new courses being introduced for the first time are: Brittle Tectonics, Fluid Inclusion, Petroleum Prospect Evaluation, Environmental Geochemistry, Instrumentation in Geochemical Analysis and Cross Section Balancing.

There has been a spurt of activity in the county in Petroleum Exploration. A number of companies in the private sector as well as in public sector have been actively engaged in oil exploration, both onshore and offshore. Besides, in the next decade it seems there will be a tremendous growth in IT related geosciences sector. India is well poised to become an international hub for global geological database generation, processing and interpretation, and a centre for geoscientific manpower outsourcing. The M.Tech. course aims to focus on all these aspects and gear up to the challenges to provide adequate training to the students. All this require a large resource of trained manpower. The five-year integrated M.Tech. programme, with its high level of quality training, will go a long way in meeting the needs of trained geologists in the future.

53. GEOPHYSICAL TECHNOLOGY

The Five year Integrated M.Tech. Programme in Applied Geophysics is aimed at training the students in different aspects of Geophysical Technology in an integrated manner. The emphasis of the course will be on Applied Geophysics. The aim is to train the students in the latest technological advancements in the field of Applied Geophysics. The training will focus on developing the capability to acquire, process and interpret geophysical data. The course will aim at training the students in seismology, petroleum geophysics, mineral exploration, groundwater exploration, geotechnical investigation, environmental geophysics and borehole geophysics. A special feature of the course will be the training of the students in Geophysical Inversion, and Geophysical Data Processing and Interpretation.

Due to increase in the exploration activity in oil sector, a number of companies in the public and private sector have been actively engaged in oil exploration, both onshore and offshore. The activity in exploration is expected to intensify further resulting in increased demand of trained personnel. A number of other companies in the IT sector are also taking up work related to processing and interpretation of Geophysical data, related mainly to oil sector. All this require a large resource of trained manpower. The five-year integrated M.Tech. programme in Applied Geophysics, with its high level of quality training, will go a long way in meeting the needs of trained geophysicists in the future.

54. ENGINEERING PHYSICS

The Five Year Integrated M.Tech. in Engineering Physics will train young students in the areas of Space Physics, Plasma Physics, and Fibre Optics. Courses in Solid State Physics, Quantum Mechanics, Thermodynamics, Statistical Mechanics, Materials Physics, MHD, Applied Nuclear Science, and Remote sensing will be included. In addition the courses from other Engineering Departments e.g. Electronics Engineering, Electrical Engineering, Computer Science & Engineering, Materials Science & Technology will also be included. Thus the training imparted to the students will be broad based, employment-oriented and will cover the frontline areas.

We are looking at students with exceptional abilities who will ultimately provide sustainable competitive advantage to the Indian industry in the area of design and manufacturing of new products in the increasingly globalised economic environment in modern science and technology. Students will have employment opportunities with ISRO laboratories, VSSC, PRL, NPL, Defence Science, Telecom Service, Industries apart from teaching institutions.

55. INDUSTRIAL CHEMISTRY

Modern chemical industries make synergistic use of chemistry, chemical technology, and chemical information technology. This programme focuses on training students for such national and international industrial manpower requirements. Keeping this in view, in the first two years of the programme the students will study courses in graduate level Physics, Chemistry, Mathematics, and applications of computer and information technology to chemical and engineering problems. Concurrently they will also be required to study basic chemical, electronics and electrical engineering courses. In the third year, the students will take applied chemistry courses emphasizing different areas of Industrial Chemistry. Subsequently in the fourth year, the students get basic inputs in frontier areas of Chemistry such as Drug design, Bio and Chemi-informatics, Corrosion and Environmental sciences, High tech materials etc. and will also be required to work for projects related to one of these areas. Based on this, in the last two semesters of the programme, students will study elective courses and work for their M.Tech. Dissertations. Students of this programme would thus have a broad training over different related areas of modern Industrial Chemistry while developing expertise in some areas of their choice.

56. MATHEMATICS AND COMPUTING

This is a new programme which replaces and upgrades five-year integrated M.Sc. in Mathematics and Computer Applications. The objectives of the programme are to train students to handle problems in industries and government organizations through the combined use of mathematical and computer techniques. The programme imparts the necessary knowledge of numerical and computational techniques, various topics in computer science, mathematical modeling, simulation, probabilistic and statistical tools and trains them to develop their own

computer software for several applications which they may come across in their professional career. Some of the typical courses in the programme are computer architecture, computer graphics, image processing, DBMS, programming languages, theory of automata, parallel algorithms, optimization methods and applications, statistical methods and algorithms, neural computing, fuzzy sets and applications, scientific visualization, etc.

57. POLYMER SCIENCE AND TECHNOLOGY

The ever-increasing industrial demand for polymers and their products have generated a rapidly growing demand for qualified manpower in the area of polymer science and engineering. The academic institutions, R&D organizations, and user industry dealing with polymers/ plastics and composites need a large number of quality scientists and engineers specializing in polymer science and technology.

To fill-in this need, a five-year integrated M.Tech. programme in Polymer Science and Technology is offered at the Saharanpur campus of IIT Roorkee. This programme is a blend of basic sciences, engineering and polymer science and technology. The students will be exposed to various aspects of science and technology of polymers, their synthesis, characterization, testing, processing, and applications in nanotechnology, aerospace, electronics, etc.

The first year of this programme is common with that of the first year of B.Tech. programmes. The second year is devoted to basic sciences, viz. physics, chemistry, mathematics, and engineering sciences. The third to fifth year of the programme covers the courses on polymer science, technology, engineering, and elective courses from different departments of the Institute. The strong flavour of chemical engineering, mathematics, and engineering sciences makes this programme unique in its structure and utilitarian in its employment potential.

3.10 FIVE-YEAR M.TECH. DUAL DEGREE COURSES

In addition to the 4-year B.Tech. degree programmes, some dual degree (B.Tech. & M.Tech.) programmes are also available. The salient features of the dual degree programmes are:

- ~Two degrees (B.Tech. & M.Tech.) will be given at the end of 5 years, but the requirements for B.Tech. degree will not be completed at the end of the fourth year.
- ~Up to second year, the courses will be common with the corresponding 4-year B.Tech. programme. Third year onwards electives for dual degree students will be in the area of their M.Tech. specialization.
- ~Project work will start in summer of fourth year and extend through thenineth year (14 months).

58. AEROSPACE ENGINEERING

Aerospace engineers are concerned with the design, analysis, construction, testing and operation of flight vehicles. The basic courses are based on the fundamentals of Fluid Dynamics, Materials Science, Structural Analysis and Development of Computer Software. The M.Tech. programme has common core in the areas of Aerodynamics, Aerospace Technology, Design, Propulsion and Structures. A number of electives are available for specialization in areas related to Aerospace Engineering. Project work of fourteen months duration will be in one of the areas of Design, Analysis and Control of modern aircrafts, space vehicles, engines and flight machines. Modern experimental facilities are available for project work.

59. AEROSPACE ENGINEERING WITH M.TECH. IN APPLIED MECHANICS WITH SPECIALIZATIONS IN BIOMEDICAL ENGINEERING

As we head into the new millennium, the ability to gather and apply new scientific knowledge from diverse areas will constitute skills critical for the students. With this foresight, and by virtue of its interdisciplinary composition, the Department of Applied Mechanics, IIT Madras, has introduced a unique interdisciplinary Dual Degree programme with various Departments. The program with Aerospace Department is expected to cater to the exponential demand of biomedical engineers in Indian and International aerospace industries.

At the end of successful completion of 5 years, the student will be offered a B.Tech degree in Aerospace Engineering and an M.Tech degree in Applied Mechanics with specialization in Biomedical Engineering. With basic knowledge in Aerospace Engineering and a specialized knowledge in the area of biomedical instrument-tation, biomechanics, quantitative physiology and biomedical imaging would provide a unique set of skills and the students can take challenging tasks in interdisciplinary areas.

The Department of Applied Mechanics has been offering M.Tech degree for the last 40 years. Students from various Engineering colleges with background in Aerospace Engineering, Civil Engineering, Mechanical Engineering, Naval Architecture and Electrical Engineering are admitted to the programme. Due to the interdisciplinary character of the Applied Mechanics Department, the student who graduates with the M.Tech degree in Applied Mechanics are much sought after in core jobs by organizations like GE, Philips, Siemens, Johnson and Johnson, IBM, GM, TATA etc. A similar trend is also expected for the graduates from the Dual Degree programme of Applied Mechanics. Applied Mechanics department also provides an excellent environment that nurtures the students who wish to pursue a research career.

60. AGRICULTURAL AND FOOD ENGINEERING WITH M.TECH. IN ANY OF THE LISTED SPECIALIZATIONS

The department offers seven specializations under the Dual degree programme. A comprehensive coverage of all essential aspects of Agricultural & Food Engineering will be provided in the first three years. A dual degree student has the flexibility to opt for anyone of the following M.Tech. specializations based on his/her own choice and performance at the end of the third year:

(i) Farm Machinery & Power

(ii) Soil and Water Conservation Engineering

(iii) Dairy and Food Engineering

(iv) Water Resources Development and Management

(v) Aquacultural Engineering

(vi) Agricultural Systems and Management

(vii) Post Harvest Engineering

The course in *Farm Machinery & Power* aims at developing and disseminating engineering knowledge and skills for the mechanization of farm operations, utilization of farm power and alternative energy resources in sustainable agricultural production and environmental management. It also focuses on design and automation of farm machines and operations for precision agriculture with emphasis on ergonomics, safety and health.

The course in *Soil and Water Conservation Engineering* aims at developing and disseminating knowledge and skills for the conservation and management of soil and water resources to attain sustainable agricultural production by applying engineering principles of hydrology and design of soil and water conservation, irrigation and drainage structures. An extensive exposure is given on techniques of remote sensing for land and water resources and numerical methods in water resource engineering.

The course in *Dairy and Food Engineering* aims at developing knowledge and technical know-how in food science and engineering for industrial production of dairy and food products. To meet the technological demands of dairy and food industries, the major emphasis is given on mathematical modeling and simulation of food processing operations for the design of machines and optimization of processes.

The course in *Water Resources Development and Management* has been designed to develop and disseminate knowledge and skills for the development and management of water resources in regions of varying geology, topography, and climate by applying the engineering principles and techniques of hydrology, remote sensing, GIS, irrigation water management, system analysis, and mathematical modeling.

The course in *Aquacultural Engineering* aims at imparting knowledge and skills for the development of aquacultural facilities and production of fish by applying the engineering principles and practices to aquaculture. To meet the demand of fisheries and several other organizations dealing with the engineering aspects of aquaculture, the students are trained in fishery biology, Open channel hydraulics and coastal engineering, planning and design of aquacultural projects, aquacultural facilities and equipment, aquacultural systems analysis, fish processing and fishing crafts and gears.

The course in *Agricultural Systems and Management* aims at imparting knowledge and technical know-how for augmenting and sustaining agricultural productivity in the perspectives of limiting resources, degrading environment, and increasing demand for agricultural produce by applying the principles and practices of the systems approach to agricultural management. The programme has an optimum mix of agricultural science, engineering and management courses with built-in flexibility through a large number of elective subjects.

The course in *Post Harvest Engineering* is designed to impart knowledge and technical know-how to Agricultural / Mechanical /Chemical / Biochemical engineers for developing high value agricultural produce and products by applying the engineering principles and practices of post-harvest processing and preservation of grains, fruits, vegetables and products of plantation crops. The areas include all operations from harvesting to consumption of food products and utilization of the resultant by-products.

61. BIOCHEMICAL ENGINEERING

The dual degree course in Biochemical Engineering emphasizes mainly on the emerging input to engineering aspects of biotechnology. It relies heavily on Enzyme Engineering, Bioreactor Design, Chemical Engineering, Down Stream Processing and Bioseparation Engineering. Due importance is given to Microbiology, Biochemistry, Molecular Biology, Genetic Engineering and Microbial/Plant/ Animal Biotechnology. The importance will also be given to new areas viz. Bioinformatics, Immunology, Nano-biotechnology, IPR in biotechnology and the like.

The main objective of the programme is to generate new brand of students with the knowledge of both biology and engineering who can deal with the problems related to the biotechnological industries, R&D organizations and they may also be outstanding input to the academic institutions.

62. BIOCHEMICAL ENGINEERING AND BIOTECHNOLOGY

The course as offered by IIT Delhi is designed to provide the students a balanced education in various science and engineering subjects that covers a wide range of disciplines. It relies heavily on bioprocess engineering, chemical

engineering and downstream processing. Due emphasis is given to biochemistry, microbiology, molecular biology and genetic engineering. The main objective of the programme is to equip the students with the capability of innovation, analysis, design and optimal operation of the processes in which biochemical catalysis has a fundamental and irreplaceable role.

Main features of this programme include the study of biological sciences with a unified cell concept in a quantitative manner- a shift in the learning concepts of chemical engineering from classical unit operations to transport phenomena.

Practice School (optional) in the last semester is designed to develop student's ability to apply the knowledge of biochemical engineering to the problems of industry that would accelerate one's professional development. Projects may include solution of various problems concerning sterility, bioreactor productivity, recombinant cell's stability, wastewater treatment, etc. Solution of such problems may result in emergence of alternate designs and integration of technology.

The broad based education and integrated study of the biological sciences with engineering arts and sciences prepare the students for variety professional careers like Planning, production and management of bioprocess industries such as foods, pharmaceuticals, organic chemicals and pollution control; industrial R&D; Academic research in applied biological sciences and biochemical engineering; Science and technology planning.

63. BIOENGINEERING WITH M.TECH IN BIOMEDICAL TECHNOLOGY

The dual degree programme aims at integrating the engineering principles and technology to analyze and solve biological and medical problems. The course also bridges the gap between the Biomedical Sciences and Engineering & Technology. The program is designed to nurture the students' inherent curiosity and to provide them strong scientific and technical base, to develop skills to upgrade and apply their knowledge to serve the ever expanding requirement of Bioengineers and Biomedical Technologists in Industry, Hospitals and R&D organizations.

The students admitted to the dual degree programme, will get theoretical and practical training in the subjects like Basic Sciences, Computer Applications, Engineering Drawing, Biology with special emphasis on Human Anatomy/ Physiology, Microbiology, Bio-chemistry, Electronic Devices and Circuits, Microcontroller and Microprocessor, Polymer Technology, Biomaterials, Composite and Nano-materials, Biomechanics, Control Biomedical Instrumentation. The students will be also exposed to the research environment through the project and dissertation work in the frontier areas of Bioengineering & Biomedical Technology.

64. BIOTECHNOLOGY

The basic features of the B.Tech. curriculum mentioned earlier in this brochure are also applicable to this programme. In addition, the dual degree programme prepares the student for research in frontier areas of Biotechnology. The curriculum for the first five semesters is identical to the B.Tech. programme in Biotechnology, but this programme provides a better well-grounded development in Biotechnology through specialized courses and a dedicated research project in the final year. Further, the electives offered for the dual degree programme are more varied and numerous compared to the B.Tech. curriculum.

The Department offers state-of-the-art facilities to conduct research in areas such as Bioprocesses, Computational Biology, Medical Genetics and Biomedical aspects, and others, with a focus toward Cardiovascular Healthcare, a current research thrust in the Department. The students are encouraged to do their final year projects in the above areas.

'Hands On' experience in working in such exciting areas will certainly hone the research skills of students in the Dual Degree programme, who would be better prepared for placement and entrepreneurial opportunities in the research-intensive biotechnology industry and for taking up graduate study in any world-class academic institution.

65. BIOTECHNOLOGY AND BIOCHEMICAL ENGINEERING

This course is an extension of the 4-year B.Tech. Programme. The course gives special emphasis on professional subjects, such as Recombinant DNA Technology, Immunotechnology, Immobilization Technology, Biotechnology of Plant Metabolites, Bioseparation, Bioprocess Plant and Equipment Design, etc., in addition to the subjects covered in 4-year B.Tech. programme. It also includes special laboratory classes in the above areas.

The Courses offered in the fifth year instill confidence and competence in areas of recombinant therapeutics, diagnostics, Bio processed food, new generation drug development etc. The project work enables hand-on exposure and research planning necessary for a modern bio-industries or related R&D.

Both B.Tech. and M.Tech. degrees will be given in the same area.

66. CERAMIC ENGINEERING

The theory and practical subjects for Four-Year B.Tech. Program and Five-Year B.Tech.-M.Tech. dual degree program in Ceramic Engineering are identical up to the third year. It lays down the foundation of knowledge for processing, manufacturing and characterization of whole range of ceramic materials and products. During fourth and fifth years of the

dual degree programme, the candidates will have option of selecting elective courses in the specialized branches of Ceramic Engineering as well as the topic of the Post graduate dissertation work. These specialized areas are pottery, porcelain and heavy clay ware, cement technology, refractory technology, glass and glass ceramic technology, electronic ceramics, engineering ceramics, ceramic coatings, bio ceramics etc. The graduates with this dual degree will have potential for working in industrial organizations. There will be ample opportunities for higher studies and employment in Research and Development Organizations and Academic Institutions in India and abroad.

67. CHEMICAL ENGINEERING

The major thrust of this dual degree course in Chemical Engineering at IIT Bombay, Delhi, Kanpur, Kharagpur, and Madras is to prepare an incumbent for advanced applications in industry, R&D, and academics. The course imparts advanced concepts in specialized areas such as, computer-aided process engineering, intelligent automation and control, advanced separation processes, interfacial science, high temperature technology and combustion, multiphase systems, biosystems engineering, nanosciences etc. A student with this degree is adequately equipped for taking up challenges in the newer areas in chemical engineering.

68. CHEMICAL ENGINEERING WITH M.TECH. IN HYDROCARBON ENGINEERING

This dual degree 5-year integrated B.Tech. (Chemical Engineering) and M.Tech. (Hydrocarbon Engineering) programme at IIT Roorkee caters to the needs of the hydrocarbon sector - petroleum and natural gas - as also the petrochemical, chemical and allied industries. With the new oil and gas finds in the country and the availability of large reserves of natural gas hydrates in the off-shore sea bed regions, the importance of hydrocarbon (petroleum and natural gas) as an energy source and raw material for the production of chemicals has raised manifold.

The students admitted to this programme will be taught all the chemical engineering courses of normal B.Tech. (Chemical Engineering) programme and the additional courses on the upstream (exploration, reservoir engineering, pretreatment and transport of hydrocarbons) and the downstream (treatment, storage, refining, secondary and tertiary processing) processes and operations including blending and transport. There will be common teaching and examination scheme for B.Tech. (Chemical Engineering) and the dual degree programmes. The students will be exposed to petroleum geology, oil and gas exploration techniques, reservoir engineering, oil and gas processing during the first seven semesters. They will undergo eight week training at one of the refineries/gas and oil processing facilities. From seventh semester, the students will be exposed to courses on hydrocarbon processing, analysis, modeling and simulation, operation processes, catalytic processes, process integration, oil and gas transportation, etc. The dissertation work during the tenth semester will involve detailed project work on an important topic related to hydrocarbon engineering. There will be enough electives to provide flexibility and choice of courses to the students.

This programme will expose the students to the exploration of natural gas and its hydrates, exploitation and transport of the gas, their processing and design. The programme offers extensive exposure of CAD and simulation software for the advanced training of the students. Environmental protection and energy efficient processing shall form an integral part of the curriculum. The programme will have intensive collaborative instructional and laboratory arrange-ments with the National Research Laboratories and the user hydrocarbon industries/ organizations. The student undergoing this programme shall have enough opportunities for placement.

70. CIVIL ENGINEERING

The aim of this dual degree program at IIT Kanpur is to enable the students to provide a strong foundation in Civil Engineering at the undergraduate level, and then learn specialized skills and acquire advanced knowledge in one or more areas of Civil Engineering. The demand for Civil Engineering with advanced training beyond the B.Tech. level is increasing. A stage may be reached soon when a masters degree would be almost a necessity for meaningful contribution as a Civil Engineering professional. This program addresses this emerging need by offering both undergraduate and postgraduate level education in an efficient, compact and meaningful manner.

In order to make this course useful and flexible, a student would be able to choose an appropriate topic for M.Tech. thesis, and the masters level courses would be primarily based on the student's interest and thesis topic. There are seven different specializations in the Civil Engineering Department at IIT Kanpur, i.e. Environmental Engineering, Engineering Geosciences, Geoinformatics, Geotechnical Engineering, Hydraulics and Water Resources Engineering, Structural Engineering, and Transportation Systems Engineering. The student would get the opportunity to credit courses cutting across these specializations, and develop a broad view and specialized knowledge in different areas of Civil Engineering. This would be conducive to acquiring in-depth knowledge in more than one specific area. The main aim of this program is to produce professionals who can take leadership roles globally, equipped with in-depth knowledge in more than one specific area of Civil Engineering.

71. CIVIL ENGINEERING WITH M.TECH IN APPLIED MECHANICS IN ANY OF THE LISTED SPECIALIZATIONS

As we head into the new millennium, the ability to gather and apply new scientific knowledge from diverse areas will constitute skills critical for the students. With this foresight and by virtue of interdisciplinary nature, the Department of

Applied Mechanics, IIT Madras, has introduced a unique interdisciplinary Dual Degree programme with various Departments.

At the end of successful completion of 5 years, the student will be offered a B.Tech degree in Civil Engineering and an M.Tech degree in Applied Mechanics. As of now the Civil Engineering students are expected to specialize in Applied Mechanics in the area of Solid Mechanics / Fluid Mechanics / Biomedical Engineering. Based on the students' choice and performance records as well as availability of seats for each of the specializations, the students can choose the M.Tech specialization at the end of seventh semester.

Basic knowledge in Civil Engineering and specialized knowledge in the area of Solid Mechanics / Fluid Mechanics / Biomedical Engineering would provide a unique combination and hence the students can take challenging tasks in interdisciplinary areas. The Department of Applied Mechanics has been offering M.Tech degree for the last 40 years. Students from various Engineering colleges with background in Aerospace Engineering, Civil Engineering, Mechanical Engineering, Naval Architecture and Electrical Engineering are admitted to the programme. Due to the interdisciplinary character of the Applied Mechanics Department, the student who graduates with the M.Tech degree in Applied Mechanics are much sought after in core jobs by organizations like GE, GM, TATA and also in software jobs such as TCS, Infosys, Cognizant etc. A similar trend is also expected for the graduates from the Dual Degree programme of Applied Mechanics. Applied Mechanics department also provides an excellent environment that nurtures the students who wish to pursue a research career.

72. CIVIL ENGINEERING WITH M.TECH. IN INFRASTRUCTURAL CIVIL ENGINEERING

Infrastructure is seen as one of the key drivers for economic growth the world over. In India, a large portion of the budget and a significant portion of the GDP (nearly 6%) is invested in the infrastructure sector today. In the next six years, India will be investing Rs. 3,20,000 crores for the development of infrastructure projects viz., roads, ports and harbours, airports, pipe line etc. The boom in infrastrucsture investment has widened the gap between demand and supply of qualified and trained graduate engineers specialized in the area of Infrastructural Civil Engineering. Engineers specialized in infrastructural engineering are therefore in great demand and they have a key role to play in planning, design, construction, and maintenance and asset management of the various infrastructure projects in the country in the years to come.

The dual degree programme in Infrastructural Civil Engineering at IIT Madras is an inter-disciplinary programme which provides the students an opportunity to gain knowledge and expertise to plan, design and manage various infrastructure projects. The students will learn basics of Civil Engineering with additional exposure to advanced topics in planning and design of infrastructure projects in the areas of transportation engineering, water resources, environmental engineering apart from construction, planning and management. In addition, the students will also be exposed to courses in finance and management viz., infrastructure finance, infrastructure planning and management. The students will be facilitated to take up internships with reputed national and multi-national infrastructure firms to obtain hands on experience in infrastructure planning and management. The current and future demand for infrastructure specialists is such that students specialized in Infrastructural Civil Engineering programme are likely to be presented with very lucrative and challenging job offers and also opportunities to pursue higher education at reputed institutions in India and abroad, upon completion of this programme.

73. CIVIL ENGINEERING WITH M.TECH. IN STRUCTURAL ENGINEERING

M.Tech. (Dual Degree Programme) in Structural Engineering has been started due to its high demand in the market. With the basic knowledge of civil engineering and specialized training in structural engineering, students will have in-depth knowledge of materials of construction, numerical techniques and IT applications to different types of problems such as Structures under random excitation, Fluid-structures under interaction, Shell structures, Composite structures, Biomechanics, Reinforced concrete members, Bridge structures, and Restoration of structures. The programme is well designed to choose either experimental or theoretical investigations including applications of computer in computer aided designs.

After completing the programme, the students will feel confident both as a research scientist and professional civil engineer.

74. CIVIL ENGINEERING WITH M.TECH. IN ANY OF THE LISTED SPECIALIZATIONS

B.Tech. in Civil Engineering and M.Tech. (Dual Degree programme) will Structural Engineering specialization was started in the year 1999. With the successful launching of this dual Degree programme, it has now been decided to extend this programme also with the specializations that are offered for two-year M.Tech. programme. Accordingly students admitted under dual Degree programme will have options to join any of the specializations and will be able to exercise their options after Fourth Semester to select any of the specializations listed. It is expected that the students will be in a better position to take a decision about the specializations once they are in the programme. The programme is well designed to specialize a civil engineering graduate in different areas of civil engineering through both experimental and theoretical knowledge including applications of computer in the design areas.

It is expected that with the basic knowledge in Civil Engineering and specialized training in any of the fields listed,

students will have an in-depth knowledge to take up challenges in future. After completing the programme, the students will feel confident both as research scientist and a professional specialized civil engineer.

75. COMPUTER SCIENCE AND ENGINEERING

This course at IIT Bombay, Delhi, Kanpur, Madras, and IT, BHU is concerned with the theoretical foundations of Computer Science, Programming, Engineering aspects of the Design of Computers (both hardware and software) and Application, Computer Communication and Networking, Aspects of Information Technology, and Design of Computer based Control Systems. At the M.Tech. level the areas of specialization are Computer Design, Software Engineering, VLSI Design, Expert Systems, Parallel Processing, and Sophisticated Computer Applications. General electives are offered in all the above areas. Final project of fourteen months duration will be on a problem of relevance to Industry.

The dual degree programme at IIT Delhi allows students to specialize in one or more areas of their interest developed during the first three years of the common undergraduate programme and delve deeper into concepts and ideas that are of interest to industry and academic research, culminating in a Master's dissertation which may be publishable, whose ideas may be patentable or even produce a product of interest to industry.

The dual degree course at IIT Kharagpur aims at providing strong foundation on different aspects of Computer Science and Engineering with emphasis on Computer Architecture, Compiler Design, Operating System, Computer Networks, Design and Analysis of Algorithms, Automata and Formal language Theory, Artificial Intelligence emerging trends and its applications in different fields.

The dual degree programme at IIT Madras prepare the students in all aspects of computer Science and Engineering with emphasis on programming, Engineering aspects of the design of Computers (both hardware and software) and applications, Computer Communications and Networking, aspects of Information Technology, and Design of Computer based Control Systems. Advanced electives are offered in all the above areas. Final project of fourteen months duration on a specific topic has to be carried out.

Both B.Tech. and M.Tech. degrees will be given in Computer Science and Engineering.

76. COMPUTER SCIENCE AND ENGINEERING WITH M.TECH. IN INFORMATION TECHNOLOGY

Information Technology is a merger of computer and communication technologies. It also covers management techniques used in information handling and processing, its applications, computers and their interaction with man and machines and associated social, economic and cultural issues. Today, the Information Technology scenario in India is at its peak and the objective is to make India an IT super power.

This dual degree programme in Computer Science and Information Technology, offered by IIT Roorkee, aims at providing a strong foundation in different areas of Computer Science and Engineering through courses on Computer Architecture, Compiler Design, Operating Systems, Computer Networks, Design and Analysis of Algorithms, Microprocessor and Interfacing etc. In the last four semesters of the programme, a number of core and elective courses relevant to Information handling and processing have been introduced. These include Information Security, Multimedia Technology, Mobile Computing, Data Mining, Neural Networks, Management Information Systems, Telecommuni-cation, Switching Networks, Network Performance and Evaluation etc. In addition, the students have to complete a project, a seminar and dissertation as part of their curriculum.

77. ELECTRICAL ENGINEERING

This dual degree course aims at providing a strong foundation in all the diverse areas of Electrical Engineering, including Electronic Circuits and Devices, Microprocessors, Communications, Signal Processing, Electromagnetics, Control, Power Systems, and Power Electronics, during the first three years of the programme. The student is, thereafter, required to specialize in one of the major streams of Electrical Engineering by taking appropriate electives and carry out independent thesis work. The streams available are, (a) Power and Control, (b) Information Systems, (c) Microelectronics, VLSI and Display Technology, and (d) Microwaves and Photonics. The stream of specialization is decided on the basis of availability of seats, and the performance of the students in the first three years. Both B.Tech. and M.Tech. degrees will be awarded in Electrical Engineering.

78. ELECTRICAL ENGINEERING WITH M.TECH. IN APPLIED MECHANICS WITH SPECIALIZATION IN BIOMEDICAL ENGINEERING

As we head into the new millennium, the ability to gather and apply new scientific knowledge from diverse areas will constitute skills critical for the students. With this foresight, and by virtue of its interdisciplinary composition, the Department of Applied Mechanics, IIT Madras, has introduced a unique interdisciplinary Dual Degree programme with various Departments. The programme with the Electrical Engineering Department is expected to provide biomedical engineers for the rapidly growing health care sector both Nationally and Internationally.

At the end of successful completion of 5 years, the student will be offered a B.Tech degree in Electrical Engineering and an M.Tech degree in Applied Mechanic with specialization in

Biomedical Engineering. Basic knowledge in Electrical Engineering and specialized knowledge in the areas of biomedical instrumentation, biofeedback control systems, biomechanics, quantitative physiology and biomedical imaging would provide the student a unique combination and hence the students can take challenging tasks in interdisciplinary areas.

The Department of Applied Mechanics has been offering M.Tech degree for the last 40 years. Students from various Engineering colleges with background in Aerospace Engineering, Civil Engineering, Mechanical Engineering, Naval Architecture and Electrical Engineering are admitted to the programme. Due to the interdisciplinary character of the Applied Mechanics Department, the student who graduates with the M.Tech degree in Applied Mechanics are much sought after in core jobs by organizations like GE, Philips, Siemens, Johnson and Johnson, IBM, GM, TATA etc. A similar trend is also expected for the graduates from the Dual Degree programme of Applied Mechanics. Applied Mechanics department also provides an excellent environment that nurtures the students who wish to pursue a research career.

79. ELECTRICAL ENGINEERING WITH M.TECH. IN COMMUNICATIONS AND SIGNAL PROCESSING

Communication and signal processing is an area which has a tremendous impact on day-to-day life. Cellular telephones, personal communication systems, and communication on the internet are examples.

In this programme a student will take advance level courses like Computer Communication Networks, Telematics, Adaptive Signal Processing, Computer Vision, Fibre Optic Communication, Artificial Neural Networks, and Wavelets. Many of these courses will have an associated laboratory component. The students will also have an advanced level project.

80. ELECTRICAL ENGINEERING WITH M.TECH. IN COMMUNICATION ENGINEERING

Communication theory and practice has gained tremendous importance in the present day world. It is likely to continue to grow even further in the foreseeable future.

In the specialization, students are exposed to a thorough understanding of the various aspects of communication theory such as Digital Modulation Techniques, Wireless and Cellular Communication, Detection and Estimation Theory, Error Control Coding and Optical Communication. Besides, courses will be offered in the Communication Techniques, Communication Networks, Digital Signal Processing and Microwave Engineering. The program is designed such that the theory courses are supplemented with a suitable laboratory component.

81. ELECTRICAL ENGINEERING WITH M.TECH. IN INFORMATION AND COMMUNICATION TECHNOLOGY

The programme is focused on creating expertise with a broad base in Electrical Engineering and application in Information and Communication Technology. The students would be exposed to areas, like computer networks, multimedia, digital communications with emphasis on state-of-the-art project work. The graduates would be employed by major telecommunications and IT-enabled industries.

82. ELECTRICAL ENGINEERING WITH M.TECH. IN MICROELECTRONICS

Microelectronics deals with the science and technology of making integrated circuits. In this programme students get a good foundation in basic electrical engineering and electronics and go on to advanced courses and laboratories in microelectronics.

A sample of the courses offered are: Bipolar and MOS Devices, Integrated Circuit Technology and Design, Computer Aided Design of ICs, Modern Electronic Design, Digital System Design, Device Characterization, Nano Devices, Device Simulation, Integrated Sensors and Circuit Simulation. Many of these courses have an associated laboratory component.

83. ELECTRICAL ENGINEERING WITH M.TECH. IN MICROELECTRONICS AND *VLSI* DESIGN

Microelectronics and VLSI Design deals with design, processing, modeling and simulation of integrated circuits and devices. It is very a very important area with tremendous potential for research work as well as industrial applications.

Some of the courses offered in this programme are: Analog IC Design, Digital IC Design, Device Modeling, VLSI Technology, Computational Techniques in Microelectronics, Digital System, MEMS, Compound Semiconductor Devices, High-speed Integrated Circuits, Semiconductor Power Devices and Power ICs. Most of the courses have associated Laboratory Components.

84. ELECTRICAL ENGINEERING WITH M.TECH. IN ANY OF THE LISTED SPECIALIZATIONS

This integrated dual degree program offers both the B.Tech.(Hons) and the M.Tech. degrees on successful completion at the end of the sixth semester, based on students choice and performance records as well as availability of seats for each of the disciplines. The academic curriculum is the same as that of the 4-year B.Tech. (Hons) programme in Electrical Engineering for the first six semesters. From the seventh semester, the students begin to undertake post-graduate level courses in their respective areas of specialization. Considerable flexibility exists in choosing

electives. Project work begins at the B.Tech. level and gets carried over to the M.Tech. level.

85. ELECTRICAL ENGINEERING WITH M.TECH. IN POWER ELECTRONICS

There has been tremendous growth during the last two decades in the area of Power Electronics and use of power electronic converters in industrial and domestic applications. This dual degree programme addresses the important area of Electrical Engineering at the undergraduate level which includes core subject in Electrical Engineering: Electrical Machines, Power Systems, Control Systems, Instrumentation, Power Electronics, with the flexibility of choosing electives in communication, Digital Signal Processing, Artificial Intelligence. At the postgraduate level, the course is focused in Power Electronics Applications employing modern digital control tools including, fuzzy logic, ANN and expert systems control.

This course covers applications in Modern Drive Systems, Flexible AC Transmission Systems, HVDC, Active Power Filters, Switched Mode Power Supplies, UPS, etc. with projects, design, simulation and dissertation work.

86. ELECTRICAL ENGINEERING WITH M.TECH. IN POWER SYSTEMS AND POWER ELECTRONICS

This dual degree program is designed to address the important areas related to Power Engineering. The growth of Power Engineering and industry today and in future would see the convergence of several fields of Electrical Engineering. This program prepares the student to play an active role in this scenario by providing an opportunity to gather a broad base at the UG level. Students are exposed to courses in disciplines ranging from Communications, Solid State Devices, Electromagnetic Fields to the basics of Electrical Machines and Power Transmission, among others. In the PG level courses, students have an opportunity to further their knowledge in subjects related to core Power Engineering like Power Electronics, Computer Methods, High Voltage Engineering and Instrumentation. Specialization in one of these fields of Power Engineering is possible through the project in the fifth year of the programme. Both research oriented and industry related projects are possible in these areas, thereby honing the skills of the students for a bright future in Power Engineering.

87. ELECTRONICS AND COMMUNICATION ENGINEERING WITH M. TECH. IN WIRELESS COMMUNICATION

There has been an explosive growth in the wireless areas of cellular and digital personal communication services (PCS) over the past few years. According to telecommunication equipment manufacturers, there were an estimated 500 million wireless subscribers worldwide at the end of 2001, and it is projected that the total number of wireless users (of all wireless applications) by the end of the year 2010 will exceed one billion.

Wireless communications encompasses many device types and technologies, including cellular, specialized mobile radio services (SMR and ESMR), PCS, cordless, paging, microwave, satellite, wireless cable (LMDS and MMDS), packet data radio, and devices not yet in the market. In recent years, it has become more and more obvious that a convergence of the computer, telephone and wireless markets is taking place. The future of medical organizations, automotive companies, computer equipment manufacturers, software design companies, and utility companies, among others, is becoming dependent upon wireless device integration.

This course, offered by IIT Roorkee, has been designed to provide a sound foundation in Electronics and Communication Engineering followed by specialized courses in the area of wireless communication. The first six semesters are common with B.Tech. (Electronics and Communication) programme of the department. In the remaining part of the programme, a number of core and elective courses have been introduced to give an in-depth knowledge of the topics relevant to wireless engineering. Besides, the students have to complete a project seminar and dissertation as part of their curriculum

88. ELECTRONICS AND ELECTRICAL COMMUNICATION ENGINEERING WITH M.TECH. IN ANY OF THE LISTED SPECIALIZATIONS

The course provides a sound foundation in Electronics and Electrical Communication Engineering as laid out in course-15 (page 28), followed by a specialized two-semester programme in Automation and Computer Vision Engineering. This includes a number of advanced subjects in the areas of Image Processing, Artificial Intelligence, Neural Networks, Pattern Recognition, Automation and Robotics Vision, Advanced Computer Architecture, Computer Networks, Multimedia Systems, etc. The students are required to complete two major projects. The course is designed to prepare the students to undertake research, development or teaching as a career.

89. ENERGY ENGINEERING WITH M.TECH. IN ENERGY SYSTEMS ENGINEERING

The Department of Energy Science and Engineering at IIT Bombay has designed this Dual degree programme to provide specialist engineers to meet the challenges of the energy sector with cross cutting analytical skills. The development of energy systems is constra ined by the depletion of fossil fuel, local environmental impacts (for example adverse health impacts) and the problem of global warming and associated climate change. Energy security concerns also dictate the search for alternative transport fuels to reduce the dependence on imported oil. There is significant need for engineering, design, research and development inputs in

building efficient conventional energy systems, cost effective renewables, new energy sources and conversion devices.

The course has been designed for the energy sector with courses related to mechanical engineering (thermodynamics, heat transfer, fluid mechanics), electrical engineering (power electronics, electrical machines, power systems) and chemical engineering (combustion, transport processes). In addition to this are the core energy courses (energy management, renewable energy, nuclear energy, modeling, energy economics) providing the required background for analysing and designing energy systems. The course has an energy innovation laboratory and an energy design project apart from the Dual degree project. A variety of energy related electives are available for the student to choose based on their interests.

The energy sector provides tremendous opportunities for analysis, design of energy efficient equipment and systems, innovative financing and project management, technology development and fundamental research. Engineers with inter-disciplinary skills and an understanding of energy systems will be in demand in energy supply companies, energy consulting and financing companies, energy equipment manufacturers, energy intensive manufacturing and process industries. The background provided in this course will equip students with the tools and techniques required to analyse and improve conventional energy systems and design the sustainable energy systems of the future. There is significant scope for entrepreneurship and new start-up companies in this area. Recent advances in nano-science and nano-technology have already resulted in potential applications for new materials in photovoltaics, hydrogen energy storage, improved batteries, super capacitors, fuel cells and provide several opportunities for technology and system development.

90. ENGINEERING DESIGN WITH M.TECH. IN AUTOMOTIVE ENGINEERING

Engineering Design is an exciting dual degree programme recently introduced at IIT Madras. The programme consists of B.Tech. and M.Tech. degrees in Engineering Design with a post graduate specialization in Automotive Engineering. Speciali-zations in Robotics and Biomedical Design may be offered subsequently and the students may have the option for switch over to these fields.

The objective of the programme is to produce engineering graduates well versed in the process of design. This involves designing products to meet customer requirements, for the required quality standards, taking into account manufacturability, serviceability, reliability, human factors, efficiency of operation and economics.

The programme represents a shift in emphasis from analysis to skill sets appropriate for design, development and prototyping and will encompass best design practices followed world-over. Emphasis on creativity, efficient use of materials, sensitivity to environment and managerial skill development are some of the aspects of the program.

The curriculum focuses on the aspects of learning to learn and teaching of concepts through case studies especially in unstructured design situations.

The mission of the programme is to make IIT Madras a Global centre of Excellence in Engineering Design. We are looking at students with exceptional abilities to provide leadership to the Indian industry in the area of design and manufacture of new products in the increasingly globalised economy.

91. ENGINEERING DESIGN WITH M.TECH. IN BIOMEDICAL DESIGN

The course will be a dual degree program with a B.Tech in Engineering Design and a M.Tech in Biomedical Design. A medical equipment is any instrument, apparatus, or material that is used in diagnosing, treating, and/or preventing diseases in humans. Medical devices constitute one of the fastest growing industries. German medical devices industry is one of the largest with an estimated 100,000 employees working in more than 500 companies. Lead by giants in the field like Siemens, there are twenty or more companies with a turnover of more than 35 million Euros. An analysis of the costing of medical devices reveals that the *highest component is the intellectual content and development costs of the invention* and the actual product cost is very much less by comparison.

The major objective of this course is to develop biomedical designers who have the background to design, manufacture, test and market such products. The biomedical instrumentation as the course is called in many Indian universities, is usually tuned towards maintenance of medical instrumentation and is heavily biased towards electrical engineering. Though such courses are no doubt important, there is a need to develop biomedical designers, who have an interdisciplinary background in mechanical design, controls, mechatronics and manufacturing science. Apart from this they should be well versed in human anatomy and physiology, mechanics as applied to physiology and biology (there is a recent book titled “Cardiovascular Solid Mechanics”), biosensors, protocol and procedures for animal models, signal processing and so on. In our opinion, no such course which systematically builds a designer exists.

92. ENGINEERING PHYSICS WITH M.TECH IN ENGINEERING PHYSICS WITH SPECIALIZATION IN NANOSCIENCE

The rapid shrinking sizes of artificially fabricated structures and devices into the nanometer range is leading to a whole new world of nanostructured devices based on quantum phenomena making use of various kind of electronic, optical, magnetic superconducting and molecular materials. Many future applications in telecommunications, computing, information systems, biomaterials, and medicine will be based

on research and development in nanoscale technologies. In this perspective, Nano-physics and technology in a wider sense will be the focus of the proposed dual degree programme offered at the Department of Physics.

The program targets students with deep interest in physics and the aptitude to apply it to technological issues, without regard to formal boundaries of science and technology. The vibrant interdisciplinary atmosphere of the IITs provide a uniquely stimulating atmosphere for such an initiative.

The programme aims to promote advanced learning and applications with due emphasis on fundamentals. The graduating students should aim at careers in research and development in Universities, Research Organizations and Industrial environments. Nano-scale Physics and Advanced Materials Physics are expected to be the future building blocks for Nanotechnology and hence these uniquely trained students are expected to find unlimited challenges and opportunities to develop a rewarding R & D career

93. INDUSTRIAL ENGINEERING WITH M.TECH. IN INDUSTRIAL ENGINEERING AND MANAGEMENT

This dual degree course, offered by IIT Kharagpur, provides an in-depth background on various areas of Industrial Engineering during its B.Tech. phase. Thereafter, the students will be exposed to the integrative concepts of Industrial Engineering and Management by going through advanced courses, on production planning, system analysis, neural and fuzzy modelling, financial management, and others. During the course of the study, the students will address a variety of industrial problems through business gaming, case studies and projects.

94. MANUFACTURING SCIENCE AND ENGG WITH M.TECH. IN INDUSTRIAL ENGG AND MANAGEMENT

This dual degree course is offered jointly by the Department of Mechanical Engineering and the Department of Industrial Engineering Management at IIT Kharagpur. The programme prepares the students to implement modern concepts of Industrial Engineering and Scientific Management in manufacturing and service organizations.

Initially, the programme will provide an in-depth background in the area of Manufacturing Sciences and Engineering with exposure to basic courses in Engineering Design and Thermal Sciences. Thereafter, the students will be exposed to the tools and techniques of Industrial Engineering and Management Sciences. The programme focuses on the efficient design and operation of production systems, and includes subjects in areas like work systems design, planning of production and inventory control, supply chain management, information technology, software engineering and management, ERP, financial management and accounting, quality control, TQM and ISO 9000, manufacturing strategy, project management, quantitative modelling and computer simulation. In addition to various laboratory exercises, the students make intensive studies on real-life problems as part of their B.Tech. and M.Tech. projects.

95. MATERIALS SCIENCE AND TECH.

The last few decades have witnessed large scale technological applications of a plethora of novel and complex materials ranging from ceramics to polymers and their composites. Several of these materials possess functional and intelligent characteristics making them useful for designing smart devices and structures. The emergence of biomaterials, high temperature superconductors, carbon cluster compounds, and nanomaterials has further extended the horizons of the field of Materials Science and Technology. The subject areas of Materials Science and Technology has become truly interdisciplinary in nature. The more familiar an engineer or technologist is with the structure, properties and processing of these advanced materials, the more proficient and confident he/she would be in making a judicious selection of materials or even in designing a new material with desired characteristics for particular application. Keeping in view the ever expanding requirement of the Materials Technology Industry and R & D organizations, a dual degree 5 year programme leading to B.Tech. and M.Tech. degrees at the end of the course has been launched at IT, BHU. The courses are so designed that the students develop a comprehensive understanding of the structure, properties, processing and applications of various advanced technology materials and at the same time also acquire specialized skills and understanding in selected areas of materials technology through the various electives. The dissertation work starting from the summer semester of the fourth year through the fifth year will provide the students to develop a flavour of research in frontier areas of advanced materials in a stimulating environment.

96. MECHANICAL ENGINEERING

A comprehensive coverage of all aspects of Mechanical Engineering will be provided in the first three years of this dual degree course. Subsequently, students will specialize in one of the following four streams, Solid Mechanics and Design, Fluid and Thermal Sciences, Manufacturing Sciences, and Robotics. The area of specialization is allocated at the end of the third year on the basis of availability of seats and the preference and performance of the students. Both B.Tech. and M.Tech. degrees will be awarded in Mechanical Engineering.

97. MECHANICAL ENGINEERING WITH M.TECH. IN COMPUTER AIDED DESIGN AND AUTOMATION

Designing machines is one of the principal activities of a mechanical engineer. Easy availability of computers has added speed, accuracy and reliability and has made the overall integration of design easier. CAD has become an

important element in modern industry to perfect design, optimize material utilization, minimize cost, reduce design cycle time, and customize the activity.

This dual degree programme will focus on the fundamental issues of CAD and automation, and their applications. It will cover computer-aided stress and mechanical modeling, graphics, finite element and dynamic element packages, automatic and computer controls, microprocessors, robotics, etc.

98. MECHANICAL ENGINEERING WITH M.TECH. IN COMPUTER INTEGRATED MANUFACTURING (CIM)

Computers have revolutionized manufacturing activity by automating and integrating various stages in product design and production. One can design, visualize, analyze and simulate these activities on a computer to create a virtual manufacturing environment.

The objective of the programme is to cover in depth the fundamentals of manufacturing engineering with an emphasis on CIM. Backed up by the basic courses in Mechanical Engineering the programme will provide special courses in the areas like Computer Graphics, Computer Numerical Control, Robotics, Database, Manufacturing Automation, etc. Special elective courses on Management, Computer Science, etc. will also be available. The programme also envisages active interaction with industries in terms of sponsored M.Tech. projects.

99. MECHANICAL ENGINEERING WITH M.TECH. IN ENERGY TECHNOLOGY

The Energy Technology stream blends with basic Mechanical Engineering in the first six semesters. From the seventh semester onwards, courses pertaining to energy technology such as Design and Optimization of Energy Systems, Advanced Energy Technologies, Fundamentals of Combustion, Thermal Energy Conservation, non-conventional energy sources and Energy and Environment are included in the curriculum. The curriculum ensures that all aspects of energy technology namely sources, generation, conservation and pollution control strategies are covered. The final year project involves an in-depth study of a specific problem of current interest in energy technology. The course has been designed in such a way that the candidates will be able to take up both R & D and managerial jobs in the energy sector, that typically includes research laboratories, government agencies, power generation and distribution companies and consulting firms.

100. MECHANICAL ENGINEERING WITH M.TECH. IN INTELLIGENT MANUFACTURING

Intelligent Manufacturing under dual degree programme will cover various related topics in addition to the basic mechanical engineering areas. Present day manufacturing requires precision, repeatability and quality to satisfy the customer needs at an affordable cost. A thorough knowledge update on the computer-based technologies is needed to achieve the above goal. With this in view, CAD/CAM, Advanced Material-removal Techniques, Microprocessors, Controllers, Sensors for Intelligent Manufacturing Systems, Networking Procedures, Expert Systems and Artificial Intelligence, Flexible Manufacturing Systems, Mechatronics, Computer Aided Quality Evaluation, Management Information Systems, etc. are the areas that will be covered under various courses in Intelligent Manufacturing.

101. MECHANICAL ENGINEERING WITH M.TECH. IN PRODUCT DESIGN

This specialization is aimed at enabling the student to imbibe the essence of a holistic approach to the design of a product so that there is integrity in form, function and use. The courses cover Product Engineering, Design Synthesis, Design of Mechanical Systems, Stress and Compliance in Machine Elements, Ergonomics and Aesthetics, Mechatronics, CAD/CAM for Product Design, etc. The project can be taken up in the following areas: Design and Development of Mechanisms, Machines/Mechanical Systems, New Products, Development of CAD software for Equipment and System Design.

102. MECHANICAL ENGINEERING WITH M.TECH. IN ANY OF THE LISTED SPECIALIZATIONS

The Dual Degree courses of the Department are designed to develop manpower with basic background in Mechanical Engineering with specialized knowledge in any of the manor specific areas of Mechanical Engineering. Accordingly, the Department offers four Dual Degree programmes which are as follows:

Mechanical Engineering with M.Tech. in Manufacturing Science and Engineering

This programme essentially covers the relevant topics like CAD, CAM, Robotics, Mechatronics, Flexible Manufacturing, to provide awareness of the state-of-the-art and future trends in manufacturing.

Mechanical Engineering with M.Tech. in Thermal Science Engineering

In this course the students are given an opportunity to specialize in one or more areas of thermal engineering with special emphasis on computational fluid dynamics, simulation, modelling and optimisation of complex thermal systems.

Mechanical Engineering with M.Tech. in Mechanical Systems Design

The course encompasses all the basic subjects of Mechanical engineering and specialized subjects on solid mechanics, machine vibrations, design optimisation, fluid power control and material handling equipment needed to become an

efficient professional in the specialization of mechanical system design.

Mechanical Engineering with M.Tech. in Mechanical Systems, Dynamics and Control

In this course, the students are groomed for designing, performing dynamic analysis and control of simple to complex mechanical systems by teaching them courses in the related areas. Some of the subject area are vibration and noise control, modelling and simulation of dynamics systems, dynamics & control of robots, machine tools & other complex mechanical systems, dynamics & control of smart structures, composite materials, signal processing, mechatronics, rotor dynamics and machinery condition monitoring.

103. METALLURGICAL ENGINEERING

It is a five year program with first three years of studies common with B.Tech. programme. Major emphasis of the remaining period will be on training in advanced areas through specialization and independent research. The student has the option to specialize, through a large number of postgraduate electives, in the fields of design and development of advanced metals and alloys for structural and functional applications, Process modeling and simulation, Nanoscience and nanotechnology, Phase transformations, Deformation and fracture behavior of metals, Particulate technology, Solidification Processing and Foundry Technology, Extractive Metallurgy, Environmental degradation, Surface Engineering.

104. METALLURGICAL ENGINEERING AND MATERIALS SCIENCE WITH M.TECH. IN CERAMICS AND COMPOSITES

The introduction of new technologies has always depended to a large extent on the availability of newer, inexpensive and better materials. The development of new materials has resulted in a revolution in areas such as information technologies, telecommunications, micro-electronics, lasers, fibre optics, biotechnology, etc. Continuous development of advanced ceramics and composites with novel and unique characteristics has clearly necessitated having a specialization in this area.

The metallurgical and materials engineer of 21st century will need a thorough knowledge of the fundamentals of materials science in order to be able to participate in research, development, design and production of advanced materials. The objective of the specialization is an in-depth coverage of Thermodynamics and Kinetics, Transport Phenomena, Mechanical Behaviour of Materials, Phase Transformations and a thorough treatment of topics such as Ceramics Processing, Electronic and Magnetic Ceramics, Semiconducting and Superconducting Materials, Structure and Properties of Engineering Polymers, Composite Materials and Glasses, and Glass-based Products. Substantial exposure to design and selection of materials is envisaged.

With rapid growth of Ceramics, Polymers and Composites as structural materials, this specialization is expected to provide exciting career opportunities

105. METALLURGICAL ENGINEERING AND MATERIALS SCIENCE WITH M.TECH. IN METALLURGICAL PROCESS ENGG./ METALLURGICAL AND MATERIALS ENGINEERING

Over the past decades, considerable efforts have been devoted towards an integrated understanding of the nature of processes involved in extraction and refining downstream processing, evolution of micro and macrostructure, various evaluation and characterization techniques of materials. A process engineer should not only have a sound understanding of the scientific principles of metallurgy, but should also have sufficient expertise in engineering areas like heat and mass transfer, equipment and process design, plant engineering, instrumentation and process control, etc.

The present-day competitive environment demands modern metallurgical plants to operate at high levels of productivity and efficiency. The course is designed to produce engineers having an integrated understanding, who can contribute to process optimization and control, and design and development. There are ample job opportunities for graduates with specialization in the areas of production, design, development and research.

106. METALLURGICAL AND MATERIALS ENGINEERING WITH M. TECH. IN METALLURGICAL AND MATERIALS ENGINEERING

It is a five-year programme with the first three and half years of studies common with the B.Tech. programme. Major emphasis of the remaining period will be on education in advanced areas through specialization courses and research. The student has the option to specialize, through a large number of postgraduate electives, in the fields of Design and development of advanced materials for structural and functional applications, Process modeling and simulation, Nanoscience and nanotechnology, Phase transformation in materials, Deformation and fracture behaviour of materials, Particulate technology, Solidification processing and foundry technology, Extractive metallurgy, Environmental degradation of materials, and Surface Engineering.

107. MINERAL ENGINEERING WITH M.TECH. IN MATERIAL TECHNOLOGY

The Materials Technology stream blends with basic Mineral Engineering in the first six semesters. From the seven semester onwards courses pertaining to Materials Technology

such as Material Characterization, Composite Materials, Polymer Technology, Ceramic Materials, Refractory Materials, Carbonaceous Materials, Electronic & Magnetic Materials, Fly ash, Red Mud and Industrial Waste Materials, Heat Treatment, Bio-Mineral Processing, Sintering & Pelletization Techniques are included in the curriculum. The curriculum ensures that all aspects of Mineral Engineering and Materials Technology are covered. The course has been designed in such a way that the candidates will be able to take up both R&D and Industrial jobs in Mineral & Materials Sectors.

108. MINERAL ENGINEERING WITH M.TECH. IN MINERAL RESOURCE MANAGEMENT

Mineral Resource Management blends with basic Mineral Engineering in the first six semesters. From seven semester onwards courses pertaining to Mineral Resource Management such as Management Principles, Research Methodology & Business Statistics, Marketing Management & Research, Operation Management, Accounting, Strategic Management, Sales & Distribution, Business Support System, Human Resource Management, Supply Chain Management, International Business, Project Management, Fine Particle, Industrial Waste & Environmental Management are included in the curriculum. The curriculum ensures that all aspects of Mineral Engineering & Management are covered. The course will be jointly offered by the Department of Fuel and Mineral Engineering and Department of Management Studies.

109. MINING ENGG. / MINING ENGG. WITH M.TECH IN MINING ENGINEERING

This five-year dual degree course as offered by IIT Kharagpur lays greater emphasis on acquiring deeper knowledge, widens the scope of understanding of interdisciplinary subjects such as economics, management and advanced treatment of undergraduate subjects and on design and problem solving using computational techniques. The students would be able to enjoy wider choice of electives. The extensive project work provides opportunity for the students to analyze, to synthesize, and to creatively apply fundamental engineering principles to new problems and make useful and original contributions to this branch of engineering.

The dual degree programme at IT-BHU Varanasi and ISM Dhanbad has a multi-faceted orientation with blend of core mining engineering subjects, professional courses and allied courses relevant to the mining engineers in present global scenario. The mining engineers are concerned with mine planning, design, exploitation and processing of ore/coal. Salient course structure gives coverage on the fundamentals of basic science and engineering, mining geology, mine surveying, mine development, mine ventilation, rock mechanics, underground and surface coal & metal mining methods, environmental management, mining methods, mining machinery, mineral processing and other allied subjects. This course will be followed by PG seminar and research-based dissertation work.

110. MINING ENGINEERING WITH MBA

A five-year dual degree program leading to degrees of B.Tech. Mining Engineering and MBA has been introduced by ISM, Dhanbad. It builds on the combined strengths of the Department of Mining Engineering and Department of Management Studies of ISM. The program is designed to groom future leaders in business and technology, equipping them with both technical knowledge and managerial skills. To succeed in technology and knowledge based society, a thorough understanding of engineering and technology along with a sound knowledge of management skills are essential. Thus, this program will offer management education to selected mining engineering students by extending their stay in ISM Campus for an additional year which will be exclusively devoted to management subjects. At the successful completion of the program, the student will get B.Tech. degree in Mining Engineering as well as the degree of MBA.

111. MINING ENGINEERING WITH M.TECH. IN SAFETY ENGINEERING AND DISASTER MANAGEMENT IN MINES

Considering the importance of occupational health and safety, The Department of Mining Engineering has introduced this Dual Degree course with B.Tech, (Honors) in Mining Engineering. First of its kind in India, this course prepares the students with in-depth knowledge and hands on training in various aspects of the present and emerging fields of Safety Engineering and Disaster management.

In addition to the core courses on Safety Systems in Engineering, Rescue and Disaster Management, Legislation and Environmental Laws, this course provides opportunity to the students to acquire knowledge in emerging fields such as Human Factors Engineering, Geo-Technical Earthquake Engineering, Reliability and Quality Engineering, Application of Remote Sensing, GIS, GPS, Virtual Reality and Artificial Intelligence, Injury Epidemology and Natural Hazards Mitigation.

The multi-disciplinary nature of the course enables the students to undertake their project work and vocation in various mining, oil and natural gas industries, and national and international organizations with which the Department is interacting through sponsored research and academic collaborations.

112. NAVAL ARCHITECTURE AND OCEAN ENGINEERING

Ocean Engineering is an interdisciplinary field that is concerned with all aspects of exploration and exploitation of the resources of the oceans— oil from offshore wells, minerals from the sea bed, biological resources from the seas and energy from waves, tides, etc. Naval Architecture deals with the design, construction and maintenance of ships and other water borne vessels. Apart from the core programme in

science and mathematics, well structured courses in fluid and solid mechanics, wave hydrodynamics, offshore structures, foundation and coastal engineering are taught. The programme also imparts good design and experimental skills. A set of core postgraduate level courses are offered in the later semesters together with a number of electives dealing with more advanced topics. The courses lay particular emphasis on numerical modeling and CAD, and expose the students to nonlinear modeling tools. Excellent facilities exist for carrying out the final dissertation work aiming at original contribution in the areas of advanced design and experimental as well as numerical analysis of ocean engineering systems including marine vehicles. One of the major highlights of the programme is the opportunity it provides to carry out significant research at the postgraduate level.

A wide variety of job opportunities are available to the graduates, generally in companies dealing with offshore engineering, ship building and ship repair, shipping companies, classification societies, statutory bodies, Port Trusts, Coast Guard, the Indian Navy and consulting organizations. Apart from these, there exists select opportunities in R&D organizations such as DRDO. Because of the multidisciplinary nature of the programme, the postgraduates find employment in allied engineering professions and management areas also.

113. NAVAL ARCHITECTURE AND OCEAN ENGINEERING WITH M.TECH IN APPLIED MECHANICS IN ANY OF THE LISTED SPECIALIZATIONS

As we head into the new millennium, the ability to gather and apply new scientific knowledge from diverse areas will constitute skills critical for the students. With this foresight, and by virtue of its interdisciplinary composition, the Department of Applied Mechanics, IIT Madras, has introduced a unique interdisciplinary Dual Degree programme with various Departments.

At the end of successful completion of 5 years, the student will be offered a B.Tech degree in Naval Architecture and an M.Tech degree in Applied Mechanics. As of now, the Naval Architecture Engineering students are expected to specialize in Applied Mechanics in the area of Solid Mechanics (or) Fluid Mechanics. Based on the students' choice, performance records as well as availability of seats for each of the specializations, the students can choose the M.Tech. specialization at the end of the seventh semester.

Basic knowledge in Naval Architecture with a specialized knowledge in the area of Solid Mechanics (or) Fluid Mechanics provides a unique combination for the students to take challenging tasks in interdisciplinary areas of mechanics. The Department of Applied Mechanics has been offering M.Tech degree for the last 40 years. Students from various Engineering colleges with background in Aerospace Engineering, Civil Engineering, Mechanical Engineering, Naval Architecture and Electrical Engineering are admitted to the programme. Due to the interdisciplinary character of the Applied Mechanics Department, the student who graduates with the M.Tech degree in Applied Mechanics are much sought after in core jobs by organizations like GE, GM, TATA and also in software companies such as TCS, Infosys, Cognizant etc. A similar trend is also expected for the graduates from the Dual Degree programme of Applied Mechanics. Applied Mechanics department also provides an excellent environment that nurtures the students who wish to pursue a research career.

114. OCEAN ENGINEERING AND NAVAL ARCHITECTURE

Ocean Engineering in its broadest sense is concerned with all engineering systems in the ocean. This includes systems for exploration and exploitation of the vast oceanic resources such as offshore oil and gas, sea-bed minerals, biological resources like marine and sea food, etc. Ocean Engineering also involves systems that utilize the ocean for transportation and recreational purpose like ships and marine vehicles of different variety, submarine and underwater vehicles, pleasure crafts, floating resorts, etc. Yet another important component of ocean engineering is related to sea-coasts and its protection, and marine hazards and its mitigation through engineering solutions. In short, any system that uses the ocean, operates in the ocean or related to the ocean in some sense falls under the purview of an Ocean Engineer. Naval Architecture, an important branch of Ocean Engineering, deals primarily with ocean transportation systems such as ships. Due to its historic importance, Naval Architecture stands out as a separate entity, and a Naval Architect is primarily engaged in the process of ship design in the widest sense of the word 'design'. Ocean Engineering and Naval Architecture encompasses subjects such as marine hydrodynamics, water wave mechanics, design of marine structures, structural mechanics related to marine structures, marine construction and welding, coastal engineering, etc.

In the five years of this dual degree M.Tech. course, the students can specialize in any of the broad area of Ocean Engineering and Naval Architecture such as marine and ocean hydrodynamics, marine structures, design and construction of marine vehicles etc. through project and specialized courses. The prolonged period of project work provides an opportunity to the student to gain expertise in one of these broad areas.

Employment opportunities of Ocean Engineers and Naval Architects exist in various offshore industry, shipbuilding and ship repairing yards, marine classification societies and other government regulatory bodies dealing with marine systems, Navy and Coast Guard, coastal engineering companies, Naval Defense R&D, environmental protection agencies for coastal protection, etc. Being multidisciplinary in nature, students from this program generally receive a broad engineering background, and this helps finding employment in other allied

engineering fields as well including management and IT industry.

115. PETROLEUM ENGINEERING WITH M.TECH. IN PETROLEUM MANAGEMENT

With the fast depletion of the natural resources and the simultaneous increase in demand of energy specially Petroleum and its products, the need for a better resource management has been felt and this is the present day requirement expected by the employers from petroleum engineers who can manage optimally and economically the petroleum asset available at their disposal.

Keeping in mind this aspect this course is formulated where upto fifth semester the subjects taught are common and sixth semester onwards courses relevant to this programme namely "Energy Management & Policy", "Petroleum Resource Management" "Petroleum Marketing", "Petroleum Asset Management" etc. are introduced. By undergoing this programme students will be in an advantageous position after they join any Petroleum Industry. Moreover job opportunities will be manifold in diversified as well as in specialized fields.

116. PROCESS ENGINEERING WITH MBA

In the present day globally competitive economic environment, the industry needs to be innovative and willing to keep pace with the technological developments. Present day process plants operate at a very high capacity and constantly endeavour to improve their production efficiency with minimal energy consumption while meeting the environmental and industrial safety concerns. The operation and management of such mega plants/ industries demands the best of the talents to man them. The introduction of the elements of system engineering, optimization, process synthesis and integration to minimize energy, and mass consumption, and effluent/ emission reduction, and operations management along with the knowledge of financial and economic aspects and marketing strategies, in the engineering curriculum will enhance an engineer's versatility, innovative and leadership skills and effectiveness in his career profile.

To facilitate the above process, a 5-year integrated dual degree programme offering B. Tech. (Process Engineering) and M.B.A. has been designed. This programme will run at the **Saharanpur Campus of IIT Roorkee**. The composite programme is an integration of the best in process system engineering and management. This composite programme will provide the students opportunities to imbibe in them the knowledge and skills in the area of basic chemical and bioprocess engineering and process system engineering such as process synthesis, process integration, modeling and simulation, computer aided design, system analysis and control, environmental management, industrial safety, process and plant optimization, energy management, and innovative management techniques including enterprise resource planning, operations management, strategic management for financial resource conservation and market leadership.

The graduating students will have excellent employment opportunities in corporates, and industrial organizations, bioprocess / chemical process industries, pharma companies and service/ infrastructural sector. The graduates may also opt for design and consultancy organizations as also for entrepreneurial development.

4. TABLES AND SYLLABUS FOR APTITUDE TEST

4.1 TABLES

The data given in the **Table-1** below is based on the information available at the time of printing. Some Institutes may offer a few more courses. Information regarding these courses will be made available at the time of Counselling.

Below the code of each course, the number of seats available in the categories GE, OBC, SC and ST and of PD seats are provided. Please see the illustration below.

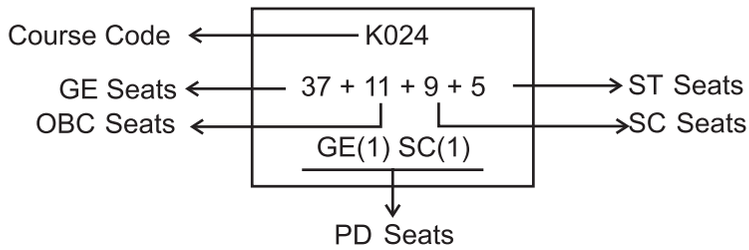

Table-1 : CODES FOR VARIOUS COURSES AND AVAILABILITY OF SEATS FOR JEE-2010

COURSE		IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
Four-year B.Tech. Courses										
1	Aerospace Engineering	B001 31+17+10+4 GE(1) OBC(1)			K001 19+10+6+3 GE(1)	G001 16+9+5+2 SC(1)	M001 19+10+5+3 GE(1)			
2	Agricultural and Food Engineering					G002 17+9+5+3 OBC(1)				
3	Biological Sciences and Bioengineering				K003 20+11+6+3 SC(1)					
4	Biotechnology			W004 27+14+8+4 GE(1) OBC(1)			M004 23+12+7+4 GE(1)	R004 24+13+7+4 GE(1)		
5	Biotechnology and Biochemical Engineering					G005 14+7+4+2 ST(1)				
6	Ceramic Engineering								V006 30+16+9+4 GE(1) OBC(1)	
7	Chemical Engineering	B007 37+20+11+5 GE(1) OBC(1)	D007 36+19+11+5 GE(1) ST(1)	W007 31+16+9+5 GE(1) SC(1)	K007 31+16+9+5 GE(1) OBC(1)	G007 26+14+8+4 GE(1)	M007 37+20+11+5 GE(1) OBC(1)	R007 28+15+8+4 GE(1) SC(1)	V007 60+32+18+9 GE(1) OBC(1) SC(1) ST(1)	
8	Chemical Science and Technology			W008 19+11+5+3 GE(1)						
9	Civil Engineering	B009 59+31+18+9 GE(2) OBC(1)	D009 55+30+16+8 GE(2) SC(1)	W009 34+18+10+5 GE(1) OBC(1)	K009 41+22+12+6 GE(1) OBC(1)	G009 31+17+9+5 GE(1) OBC(1)	M009 31+17+10+5 GE(1) SC(1)	R009 60+33+17+9 GE(2) OBC(1) SC(1)	V009 40+22+12+6 GE(1) SC(1)	
10	Computer Science and Engineering	B010 44+23+13+7 GE(1) OBC(1)	D010 32+17+9+5 GE(1) OBC(1)	W010 37+20+11+5 GE(1) ST(1)	K010 26+14+8+4 GE(1)	G010 28+15+8+4 GE(1)	M010 15+8+5+2 OBC(1)	R010 24+13+7+4 GE(1)	V010 30+16+9+4 GE(1) SC(1)	S010 47+26+14+7 GE(2) OBC(1) SC(1)

	COURSE	IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
	Four-year B.Tech. Courses									
11	Electrical Engineering	B011 30+16+9+5 GE(1) ST(1)	D011 32+17+9+5 GE(1) SC(1)		K011 50+27+15+7 GE(1) OBC(1) SC(1)	G011 28+15+8+4 GE(1)	M011 25+13+7+4 GE(1)	R011 60+33+17+9 GE(1) OBC(1) SC(1) ST(1)	V011 40+22+12+6 GE(1) OBC(1)	S011 47+24+14+7 GE(2) OBC(1) ST(1)
12	Electrical Engineering (Power)		D012 16+9+5+2 OBC(1)							
13	Electronics Engineering								V013 40+22+12+6 GE(1) OBC(1)	S013 47+26+14+7 GE(2) OBC(1) SC(1)
14	Electronics and Communication Engineering			W014 33+18+10+5 GE(1) OBC(1)				R014 28+15+8+4 GE(1) OBC(1)		
15	Electronics and Electrical Communication Engineering					G015 31+17+9+5 GE(1) SC(1)				
16	Electronics and Electrical Engineering			W016 20+11+6+3 GE(1)						
17	Engineering Physics	B017 15+8+5+2 GE(1)	D017 32+17+9+5 GE(1) OBC(1)	W017 19+10+6+3 GE(1)			M017 15+8+5+2 GE(1)			
18	Environmental Engineering									S018 31+17+9+5 GE(2) OBC(1) ST(1)
19	Industrial Engineering					G019 15+8+4+2 OBC(1)				
20	Instrumentation Engineering					G020 16+9+5+2 ST(1)				
21	Manufacturing Science and Engineering					G021 15+8+4+2 GE(1)				
22	Materials and Metallurgical Engineering				K022 47+25+14+7 GE(1) OBC(1) SC(1)					
	Metallurgical and Materials Engineering					G022 22+12+7+3 OBC(1)	M022 18+10+5+3 GE(1)	R022 48+26+14+7 GE(1) OBC(1) ST(1)		
23	Mathematics and Computing			W023 19+10+6+3 OBC(1)						
24	Mechanical Engineering	B024 47+25+14+7 GE(1) OBC(1) SC(1)	D024 52+28+15+8 GE(2) OBC(1)	W024 37+20+11+5 GE(1) SC(1)	K024 37+20+11+5 GE(1) ST(1)	G024 34+18+10+5 GE(1) OBC(1)	M024 38+20+11+6 GE(1) SC(1)	R024 40+21+12+6 GE(1) OBC(1)	V024 50+27+15+8 GE(2) OBC(1)	S024 52+28+15+8 GE(2) OBC(1) SC(1)
25	Metallurgical Engineering								V025 35+19+10+5 GE(2)	
26	Metallurgical Engineering and Materials Science	B026 34+18+10+5 GE(1) ST(1)								

	COURSE	IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
Four-year B.Tech. Courses										
27	Mineral Engineering									S027 30+16+9+5 GE(1) OBC(1) SC(1)
28	Mining Engineering**					G028 20+11+6+3 GE(1)			V028 50+27+15+8 GE(2) OBC(1)	S028 60+33+18+9
29	Mining Machinery Engineering**									S029 20+10+6+3
30	Naval Architecture and Ocean Engineering						M030 18+10+5+3 GE(1) SC(1)			
31	Ocean Engineering and Naval Architecture					G031 17+9+5+2 OBC(1)				
32	Petroleum Engineering**									S032 52+28+15+8
33	Production and Industrial Engineering		D033 24+13+7+4 OBC(1)					R033 24+13+7+4 GE(1)		
34	Pulp and Paper Engineering							R034 54+29+16+9 GE(1) OBC(1) SC(1)		
35	Textile Technology		D035 47+25+14+7 GE(2) OBC(1)							
Four-year B.Pharm. Course										
36	Pharmaceutics								V036 18+10+5+3 OBC(1)	
Four-year B.Des. Course										
37	Design**			W037 21+11+6+3 OBC(1) SC(1)						
Five-year B.Arch. Course										
38	Architecture**					G038 25+13+8+4 OBC(1)		R038 40+21+12+6 GE(1) OBC(1)		
Five-year M. Pharm. Dual Degree Course										
39	Pharmaceutics								V039 10+5+3+2 OBC(1)	
Five-year M.Sc. Intgegrated Courses										
40	Applied Geology					G040 18+10+5+3 GE(1)				
41	Applied Mathematics							R041 16+8+5+2 OBC(1)		
42	Applied Physics									S042 16+8+5+2 OBC(1)

	COURSE	IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
Five-year M.Sc. Intgegrated Courses										
43	Chemistry	B043 16+9+5+2 GE(1)			K043 14+8+4+2 OBC(1)	G043 17+9+5+3 SC(1)		R043 16+8+5+2 GE(1)		S043 16+8+5+2 GE(1)
44	Economics				K044 19+10+6+3 SC(1)	G044 22+12+7+3 ST(1)				
45	Exploration Geophysics					G045 17+9+5+3 GE(1)				
46	Mathematics and Computing					G046 24+13+7+4 GE(1)				S046 16+8+5+2 OBC(1) SC(1)
47	Mathematics and Scientific Computing				K047 25+13+7+4 OBC(1)					
48	Physics				K048 14+8+4+2 GE(1)	G048 18+10+5+3 SC(1)		R048 16+8+5+2 GE(1)		
Five-year B.S. and M.S. Dual Degree Course										
49	Physics						M049 5+3+1+1			
Five-year M.Sc. Tech. Integrated Courses										
50	Applied Geology**									S050 15+9+5+2 GE(1)
51	Applied Geophysics									S051 16+8+5+2 GE(1)
Five-year M. Tech. Integrated Courses										
52	Geological Technology							R052 16+8+5+2 OBC(1)		
53	Geophysical Technology							R053 16+8+5+2 GE(1)		
54	Engineering Physics								V054 10+5+3+2 SC(1)	
55	Industrial Chemistry								V055 10+5+3+2 ST(1)	
56	Mathematics and Computing		D056 24+13+7+4 GE(1)						V056 10+5+3+2 GE(1)	
57	Polymer Science and Technology							R057 16+8+5+2 OBC(1)		
Five-year M.Tech. Dual Degree Courses										
58	Aerospace Engineering				K058 5+3+1+1 ST(1)	G058 10+5+3+1 GE(1)	M058 7+4+1+1			
59	Aerospace Engg. with M.Tech. in Applied Mechanics with specializations in Biomedical Engineering						M059 4+2+1+1			

	COURSE	IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
	Five-year M.Tech. Dual Degree Courses									
60	Agricultural and Food Engineering with M.Tech. in any of the listed specializations*					G060 17+9+5+3 GE(1)				
61	Biochemical Engineering								V061 10+5+3+2 OBC(1)	
62	Biochemical Engineering and Biotechnology		D062 24+13+7+4 GE(1) SC(1)							
63	Bioengineering with M.Tech in Biomedical Technology								V063 10+5+3+2 SC(1)	
64	Biotechnology						M064 12+6+4+2 OBC(1)			
65	Biotechnology and Biochemical Engineering					G065 13+7+4+2 SC(1)				
66	Ceramic Engineering								V066 10+5+3+2 ST(1)	
67	Chemical Engineering	B067 26+14+7+4 GE(1)	D067 26+14+8+4 OBC(1) ST(1)		K067 8+4+2+1 GE(1)	G067 14+7+4+2 OBC(1)	M067 9+5+3+1 GE(1)			
68	Chemical Engineering with M.Tech. in Hydrocarbon Engineering							R068 13+7+4+2 GE(1)		
70	Civil Engineering				K070 12+6+4+2 GE(1)					
71	Civil Engineering with M.Tech. in Applied Mechanics in any of the listed specialization						M071 4+2+1+0			
72	Civil Engineering with M.Tech. in Infrastructural Civil Engineering						M072 7+4+2+1 OBC(1)			
73	Civil Engineering with M.Tech. in Structural Engineering								V073 10+5+3+2 OBC(1)	
74	Civil Engineering with M.Tech in any of the listed specialization *					G074 11+6+3+2 GE(1)	M074 7+4+2+1			
75	Computer Science and Engineering		D075 16+9+5+2 SC(1)		K075 20+11+6+3 GE(1)	G075 20+11+6+3 OBC(1)	M075 13+7+4+2 ST(1)		V075 8+4+2+1 GE(1)	
76	Computer Science and Engg. with M.Tech. in Information Technology							R076 13+7+4+2 GE(1)		
77	Electrical Engineering				K077 16+9+5+2 OBC(1)					
78	Electrical Engineering with M.Tech in Applied Mechanics with specialization in Biomedical Engineering						M078 4+2+1+0			
79	Electrical Engineering with M.Tech. in Communications and Signal Processing	B079 16+9+4+3 SC(1)								

	COURSE	IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
	Five-year M.Tech. Dual Degree Courses									
80	Electrical Engineering with M.Tech. in Communication Engg						M080 12+7+3+2 GE(1)			
81	Electrical Engineering with M.Tech. in Information and Communication Technology		D081 13+7+4+2 GE(1)							
82	Electrical Engineering with M.Tech. in Microelectronics	B082 16+9+5+2 ST(1)								
83	Electrical Engineering with M.Tech. in Microelectronics and VLSI Design						M083 12+6+4+2 OBC(1)			
84	Electrical Engineering with M.Tech. in any of the listed specializations*					G084 13+7+4+2 GE(1)				
85	Electrical Engineering with M.Tech. in Power Electronics							R085 8+4+2+1 GE(1)	V085 10+5+3+2 SC(1)	
86	Electrical Engineering with M.Tech. in Power Systems and Power Electronics						M086 7+4+2+1			
87	Electronics and Communication Engineering with M.Tech. in Wireless Communication							R087 9+5+3+1 OBC(1)		
88	Electronics and Electrical Communication Engineering with M.Tech. in any of the listed specializations*					G088 20+11+6+3 OBC(1)				
89	Energy Engineering with M.Tech. in Energy Systems Engineering	B089 15+8+5+2 GE(1)								
90	Engineering Design with M.Tech. in Automotive Engineering#						M090 22+11+7+3 OBC(1)			
91	Engineering Design with M.Tech in Biomedical Design#						M091 7+4+2+1			
92	Engineering Physics with M.Tech. in Engineering Physics with specialization in Nano Science	B092 6+3+2+1								
93	Industrial Engineering with M.Tech. in Industrial Engineering and Management					G093 14+7+4+2 SC(1)				
94	Manufacturing Science and Engineering with M.Tech. in Industrial Engineering and Management					G094 10+5+3+1 GE(1)				
95	Material Science and Technology								V095 10+5+3+2 GE(1)	
96	Mechanical Engineering				K096 13+7+4+2 GE(1)				V096 10+5+3+2 GE(1)	
97	Mechanical Engineering with M.Tech. in Computer Aided Design and Automation	B097 12+6+3+2 GE(1)								
98	Mechanical Engineering with M.Tech. in Computer Integrated Manufacturing (CIM)	B098 11+6+3+2 SC(1)								

	COURSE	IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
	Five-year M.Tech. Dual Degree Courses									
99	Mechanical Engineering with M.Tech. in Energy Technology						M099 12+7+4+1 GE(1)			
100	Mechanical Engineering with M.Tech. in Intelligent Manufacturing						M100 12+6+4+2 SC(1)			
101	Mechanical Engineering with M.Tech. in Product design						M101 12+6+4+2 GE(1)			
102	Mechanical Engineering with M.Tech. in any of the listed specializations*					G102 24+13+7+4 GE(1)				
103	Metallurgical Engineering								V103 10+5+3+2 GE(1)	
104	Metallurgical Engineering and Materials Science with M.Tech. in Ceramics and Composites	B104 15+8+5+2 SC(1)								
105	Metallurgical Engineering and Materials Science with M.Tech. in Metallurgical Process Engineering	B105 14+7+4+2 SC(1)								
	Metallurgical and Materials Engineering						M105 7+3+2+1 ST(1)			
106	Metallurgical and Materials Engineering with M.Tech. in Metallurgical and Materials Engineering					G106 10+5+3+1 GE(1)				
107	Mineral Engineering with M.Tech in Material Technology									S107 9+5+3+1 GE(1)
108	Mineral Engineering with M.Tech in Mineral Resource Management									S108 9+5+2+2 GE(1)
109	Mining Engineering**					G109 10+5+3+1 GE(1)			V109 10+5+3+2 GE(1)	
	Mining Engineering with M. Tech in Mining Engineering**									S109 9+5+3+1
110	Mining Engineering with MBA**									S110 9+5+2+2
111	Mining Engineering with M.Tech in Safety Engineering and Disaster Management in Mines**					G111 9+5+3+1 GE(1)				
112	Naval Architecture and Ocean Engineering						M112 5+3+2+0			
113	Naval Architecture and Ocean Engineering with M.Tech in Applied Mechanics in any of the listed specializations						M113 4+2+1+1			
114	Ocean Engineering and Naval Architecture					G114 11+5+4+2 OBC(1)				

	COURSE	IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
		Five-year M.Tech. Dual Degree Courses								
115	Petroleum Engineering with M.Tech in Petroleum Management**									S115 9+5+3+1
116	Process Engineering with MBA							R116 16+8+5+2 GE(1)		
	TOTAL : GE+OBC+SC+ST	444+237+ 133+66	429+231+ 126+65	297+159+ 88+44	417+224+ 124+62	677+362+ 201+101	423+226+ 126+63	585+311+ 173+86	531+282+ 158+86	510+274+ 152+76
	GE+OBC+SC+ST (PD)	13+5+5+3 (26)	13+7+4+2 (26)	9+5+3+1 (18)	12+7+4+2 (25)	20+11+6+3 (40)	13+6+4+2 (25)	19+11+4+2 (36)	18+10+6+3 (37)	16+8+5+2 (31)
	TOTAL : All CATEGORIES	880	851	588	827	1341	838	1155	1057	1012

Table-1 Continued

	COURSE	IIT							
		BHUBANESWAR	GANDHINAGAR	HYDERABAD	INDORE	MANDI	PATNA	RAJASTHAN	ROPAR
		A	N	H	E	C	P	J	U
		Four-year B.Tech. Courses							
7	Chemincal Engineering		N007 20+11+6+3 GE(1)SC(1)						
9	Civil Engineering	A009 20+11+6+3 GE(1)							
10	Computer Science and Enginnering			H010 20+11+6+3 GE(1)	E010 20+11+6+3 GE(1)OBC(1)	C010 20+11+6+3 GE(1)	P010 20+11+6+3 OBC(1)	J010 20+11+6+3 GE(1)	U010 20+11+6+3 GE(1)
11	Electrical Engineering	A011 20+11+6+3 OBC(1)	N011 20+11+6+3 GE(1) ST(1)	H011 20+11+6+3 OBC(1)	E011 20+11+6+3 GE(1)	C011 20+11+6+3 OBC(1)	P011 20+11+6+3 GE(1)	J011 20+11+6+3 OBC(1)	U011 20+11+6+3 GE(1)
24	Mechanical Engineering	A024 20+11+6+3 GE(1)	N024 20+11+6+3 OBC(1)	H024 20+11+6+3 GE(1)	E024 20+11+6+3	C024 20+11+6+3 GE(1)	P024 20+11+6+3 GE(1)	J024 20+11+6+3 GE(1)	U024 20+11+6+3 OBC(1)
	PD : GE+OBC+SC+ST (PD)	60+33+18+9	60+33+18+9	60+33+18+9	60+33+18+9	60+33+18+9	60+33+18+9	60+33+18+9	60+33+18+9
	PD : GE+OBC+SC+ST (PD)	2+1+0+0 (3)	2+1+1+1 (5)	2+1+0+0 (3)	2+1+0+0 (3)	2+1+0+0 (3)	2+1+0+0 (3)	2+1+0+0 (3)	2+1+0+0 (3)
	TOTAL : All CATEGORIES	120	120	120	120	120	120	120	120

A Dual Degree student has the flexibility to opt for any of the listed M.Tech. specializations based on his/her own choice and performance at the end of the third year (refer to the programme details).

** Please ensure that you satisfy the Special Requirements as given in **Section 1.6.**

Change of branch from Engineering Design dual degree (M90 and M91) to other branches and from other branches to M90 and M91 is not permitted in view of the specialized nature of the curriculum and course contents of these dual degree programs.

The total numbers of seats available in all Institutes including IT-BHU and ISM Dhanbad through JEE-2010 for different categories are given below. The numbers include 3% seats to be allotted to the PD candidates.

Category	GE	OBC	SC	ST	TOTAL
Seats	4793	2570	1425	721	9509
PD Seats	149	78	42	21	290

Table-2: OPENING AND CLOSING RANKS OF GE, OBC, SC, AND ST CANDIDATES (JEE2009)

COURSE		IIT							IT-BHU	ISM
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAB
		B	D	W	K	G	M	R	V	S
Four-year B.Tech. Courses										
Aerospace Enginnering	GE OBC SC ST PD	296-1256 347-449 51-160 92-115 84-84			891-1613 377-474 232-305 135-169 104-104	1660-2102 499-582 306-344 — —	847-1833 254-551 237-403 79-121 —-			
Agriculaural and Food Engineering						2781-4079 846-1487 959-962				
Biological Science and Bioengineering					1505-3178 1046-1404 342-898 —-					
Biotechnology				3487-4104 1350-1581 823-964 —-			855-3238 949-1112 553-825 —-	3016-3684 1144-1427 652-945 —-		
Biotechnology and Biochemical Engineering						2984-3390 934-1135 822-942 —-				
Ceramic Engineering									4713-5686 1623-1740 ---	
Chemincal Engineering		244-928 287-374 175-259 152-203 109-109	708-1100 441-516 260-359 165-207 89-89	2644-3097 756-922 593-697 —-	631-1481 334-556 346-430 —-	1391-1935 422-709 427-527 —-	960-1819 458-667 214-524 193-195 —-	1875-2292 719-754 422-575 —-	3889-4582 1018-1470 754-932 —-	
Chemical Science and Engineering				3188-3543 939-1081 708-896 —-						
Civil Engineering		665-1413 341-613 167-394 47-113 23-23	740-1678 266-676 203-384 35-93 —-	2636-3173 717-907 47-598 —-	1095-1984 662-735 109-418 118-153 —-	1601-2360 614-769 234-472 191-200 116-116	1068-2084 513-672 106-439 77-178 96-96	1688-2504 359-829 419-503 130-189 —-	3886-4594 952-1367 549-923 —-	
Computer Science and Engineering		3-86 12-45 2-26 3-9 7-99	1-154 32-77 4-48 11-28 1-1	623-2027 324-490 242-424 85-184 134-134	2-181 27-64 1-57 15-36 31-31	276-527 86-118 40-97 21-81 64-64	5-215 50-73 22-62 26-32 45-45	471-984 123-276 107-200 52-72 46-46	1872-2963 534-750 446-589 —-	3703-5299 955-1239 660-949 —-
Electrical Enginnering		8-109 20-60 3-75 1-10 6-6	108-241 74-106 23-61 14-39 34-70		39-416 81-150 69-129 12-55 39-75	596-920 207-258 137-196 17-42 41-41	32-310 84-168 24-152 19-49 20-20	848-1821 280-453 89-308 74-110 115-115	2073-3782 872-1011 531-787 —-	4229-5611 1181-1444 868-883 —-
Electrical Engineering (Power)			477-758 165-216 184-228 61-76							
Electronics Engineering									1882-3544 780-960 397-734 —-	3987-5442 1033-1465 864-953 —-
Electronics and Communication Engineering				1437-2275 405-561 301-470 144-183 —-				682-1354 202-343 98-208 123-137 21-21		

COURSE	IIT							IT-BHU	ISM
	BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAB
	B	D	W	K	G	M	R	V	S
Four-year B.Tech. Courses									
Electronics and Electronical Communication					133-762 137-213 13-141 24-104				
Electronics and Electrical Engineering			2043-2489 404-602 477-501 —-						
Engineering Physics	303-1171 203-415 331-383 —-	1238-1929 462-708 155-565 —-	2543-3273 779-999 586-789 —-			832-1640 361-648 391-581 19-19			
Environmental Engineering									5482-6646 1811-1921 935-935 —-
Industrial Enginnering					1739-2392 698-824 432-633 192-192 —-				
Instrumentation Engineering					1208-1868 497-677 408-417 —-				
Manufacturing Science and Engineering					1942-2288 839-890 541-631 —-				
Materials and Metallurgical Engineering				1774-2794 759-1053 635-820 —-					
Metallurgical and Material Engineering					2344-2968 1054-1120 510-821 —-	2134-2733 766-990 577-682 —-	2898-3382 1121-1346 583-960 —-		
Mathematics and Computing			2222-2938 655-983 780-930 202-202 —-						
Mechanical Engineering	72-494 87-210 50-159 16-67 24-62 (PD)	237-634 149-262 10-171 48-84 43-107	1693-2608 545-645 392-533 154-154 128-128	497-806 96-278 126-182 87-109 49-49	830-1191 282-331 113-240 114-136	275-820 101-277 32-170 27-80 125-125	927-1909 358-526 215-365 119-173 54-54	2389-4014 878-1154 552-806 —-	4571-5680 950-1501 786-946 —-
Metallurgical Engineering								4281-4953 1495-1655 —-	
Metallurgical Engineering and Materials Science	1179-2056 752-954 399-571 138-138 —-								
Mineral Engineering									5223-6490 1681-1805 —-

COURSE	IIT							IT-BHU	ISM
	BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAB
	B	D	W	K	G	M	R	V	S
		Four-year B.Tech. Courses							
Mining Engineering					3262-3950 1301-1517 853-958 —-			4967-6227 1614-1818 —-	4884-6183 1560-1830 —-
Mining Machinery Engineering									5603-6487 1730-1854 —-
Naval Architecture and Ocean Engineering						2152-2745 680-820 120-601 —-			
Ocean Engineering and Naval Architechture					2899-3201 915-1084 648-721 —-				
Petroleum Engineering									3769-4920 969-1373 784-963 82-82 —-
Production and Industrial Engineering		805-1225 342-675 254-509 197-198 —-					2150-2815 685-968 558-693 —-		
Pulp and Paper Engineering							3470-5344 1490-1732 —-		
Textile Technology	1930-2868 842-1395 591-824 —-								
		Four-year B.Pharm. Courses							
Pharmaceutics								5803-6964 1337-1690 —-	
		Four-year B.Des. Courses							
Design			3762-5748 1593-1692 —-						
		Five-year B.Arch. Courses							
Architecture					4537-6327 1417-1604 772-772 —		4588-7152 1799-1850 — 149-149		
		Five-year M.Pharm. Dual Degree Course							
Pharmaceutics								5889-7117 — —-	
		Five-year M.Sc. Integrated Courses							
Applied Geology					4538-5261 1021-1866 —-				
Applied Mathematics							3754-4995 1731-1922 —-		
Applied Physics									

COURSE	IIT							IT-BHU	ISM
	BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAB
	B	D	W	K	G	M	R	V	S
Chemistry	2717-3884 813-1544 —			1586-4684 1685-1781 —	3335-5287 1583-1885 —		5044-5467 1823-1823 —		6127-7063 1431-1431
Economics				3209-4138 1729-1892 966-966 —	4193-5168 1658-1929 —				
Exploration Geophysics					3391-4381 1341-1819 —				
Mathematics and Computing		348-789 349-463 173-580 —		2189-3355 704-1471 739-798 —	1568-3443 998-1403 374-658 —				6127-7063 1431-1431 — —
Mathematics and Scientific Computing									5536-6476 1822-1919 —
Physics				455-3022 821-1267 857-876 —	3221-4332 892-1852 886-886 —.		3346-4937 1820-1930 — —		
Five-year M.Sc. Tech. Integrated Courses									
Applied Geology									6579-6992 — —
Applied Geophysics									5213-6784 1688-1902 — — —
Five-year M.Tech. Integrated Courses									
Geoligical Technology							3448-4523 1603-1723 967-967 — —		
Geophysical Technology							3048-4354 1656-1754 — — —		
Engineering Physics								4087-4974 1211-1605 — —	
Industrial Chemistry								4944-5406 1660-1776 — — —	
Five-year M.Tech. Integrated Courses									
Mathematics and Computing								4035-4667 1270-1577 927-927 —	
Polymer Science and Technology							3708-4782 1626-1794 867-867 — —	—	
Five-year M.Tech. Dual Degree Courses									
Aerospace Engineering	1277-1756 547-621 188-338 — —			1766-2010 642-669 340-340 86-86 —	2155-2286 327-690 412-435 — —	1357-2066 480-635 286-357 — —			

COURSE	IIT							IT-BHU	ISM
	BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAB
	B	D	W	K	G	M	R	V	S
Aerospace Engineering with M.Tech. in Applied Mechanics with specializations in Biomedical Engineering						1488-2169 636-636 428-428 — —-			6127-7063 1431-1431
Agricultural and Food Engineering with M.Tech. in any of the listed specializations					3805-4600 1050-1636 — — —-				
Biochemical Engineering								4495-5257 1673-1762 — — —-	
Biochemical Engineering and Biotechnology		1697-2981 885-1463 91-901 — —-							
Bioengineering with M.Tech in Biomedical Technology								4680-5483 1763-1767 — —-	
Biotechnology						2478-3500 1024-1214 666-931 —-			
Biotechnology and Biochemical Engineering					3513-3688 1492-1555 689-903 — —-				
Ceramic Engineering								5121-5812 1761-1856 —-	
Chemical Engineering	943-1308 376-696 303-499 — —-	1167-1652 611-778 362-518 — —-		1641-1712 430-601 526-542 —-	1687-2158 701-803 579-609 — —-	1878-2037 725-782 550-560 — —-			
Chemical Engineering with M.Tech. in Hydrocarbon Engineering							2314-2637 815-887 600-645 — —-		
Civil Engineering				1846-2175 396-788 451-482 187-187 —-					
Civil Engineering with M.Tech. in Applied Mechanics in any of the listed specializations						2110-2244 787-787 484-484 — —-			
Civil Engineering with M.Tech. in Infrastructural Civil Engineering						2123-2335 773-799 502-519 — —-			
Civil Engineering with M.Tech. in Structural Engineering	1368-1662 492-630 415-450 13-13							4019-4677 1243-1491 819-954 — —-	

COURSE	IIT							IT-BHU	ISM
	BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAB
	B	D	W	K	G	M	R	V	S
Five-year M.Tech Dual Degree Course									
Civil Engineering with M.Tech in any of the listed specializations					2099-2537 835-859 551-563 — 97-97	2303-2405 811-834 321-405 — —-			
Computer Science and Engineering		187-278 97-132 8-64 46-53 61-61		216-422 82-141 103-146 89-117 —-	431-877 155-251 125-229 131-140 50-50	333-502 138-195 85-163 64-105 85-85		2993-3532 807-929 588-588 — —-	
Computer Science and Engineering with M.Tech. in Information Technology							973-1377 285-302 236-302 172-180 —-		
Electrical Engineering				423-608 198-252 216-248 20-65 131-131					
Electrical Engineering with M.Tech in Applied Mechanics with specialization in Biomedical Engineering						954-1026 337-337 297-297 — —-			
Electrical Engineering with M.Tech. in Communications and Signal Processing	266-379 124-205 31-165 94-133 —-								
Electrical Engineering with M.Tech. in Communication Engineering						458-764 244-264 172-194 58-163 —-			
Electrical Engineering with M.Tech. in Information and Communication Technology		284-369 178-196 68-199 91-106 —-							
Electrical Engineering with M.Tech. in Microelectronics	117-245 72-159 53-143 98-164 —-								
Electrical Engineering with M. Tech. in Microelectronics and VLSI Design						339-716 170-214 193-222 99-166 10-10			
Electrical Engineering with M.Tech. in any of the listed specializations					1012-1330 328-356 256-274 148-156 —-				
Electrical Engineering with M.Tech. in Power Electronics							1637-1915 406-519 317-341 208-208	3807-3994 879-1060 803-888 —-	
Electrical Engineering with M.Tech. in Power Systems and Power Electronics						773-937 284-330 225-258 194-194 —-			
Electronics and Commun. Engineering with M.Tech. in Wireless Communication							1271-1567 440-532 276-282 188-188 —-		

COURSE	IIT							IT-BHU	ISM
	BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAB
	B	D	W	K	G	M	R	V	S
Five-year M.Tech Dual Degree Course									
Electronics and Electrical Communication Engineering with M.Tech. in any of the listed specializations					482-1091 257-419 56-272 141-141 —				
Energy Engineering with M.Tech. in Energy Systems Engineering	294-1258 416-489 181-534 —								
Engineering Design with M.Tech. in Automotive Engineering						1188-2347 682-801 322-585 190-190 —			
Engineering Design with M.Tech in Biomedical Design						2472-2850 790-843 714-749 —			
Engineering Physics with M.Tech. in Engineering Physics with specialization in Nano Science	607-1266 485-589 — — —								
Industrial Engineering with M.Tech. in Industrial Engineering and Management					2422-2787 995-1022 508-781 — —				
Manufacturing Science and Engineering with M.Tech. in Industrial Engineering and Management					1890-2659 762-841 659-728 — —				
Material Science and Technology								4708-5296 1666-1669 — —	
Mechanical Engineering				808-992 296-370 253-289 128-134 —				3633-4136 855-1176 623-782 —	
Mechanical Engineering with M.Tech. in any of the listed specialization					1292-1544 332-537 278-385				
Mechanical Engineering with M.Tech. in Computer Aided Design and Automation	419-637 297-336 164-202 168-185 —								
Mechanical Engineering with M.Tech. in Computer Integrated Manufacturing (CIM)	556-757 344-372 227-247 — —					661-1176 423-466 293-352 40-146 —			
Mechanical Engineering with M.Tech. in Energy Technology						1082-1353 365-483 261-307 142-205 —			
Mechanical Engineering with M.Tech. in Product design						890-118 1 417-448 185-269 — —			
Metallurgical Engineering								4654-5164 1675-1682 — — —	
Metallurgical Engineering and Materials Science with M.Tech. in Ceramics and Composites	2065-2285 668-1017 604-707								

COURSE	IIT							IT-BHU	ISM
	BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAB
	B	D	W	K	G	M	R	V	S
Five-year M.Tech Dual Degree Course									
Metallurgical Engineering and Materials Science with M.Tech. in Metallurgical Process Engineering	2200-2480 1044-1067 634-744 — —				2990-3212 943-1164 866-914 —				
Metallurgical and Materials Engineering						2790-3032 1014-1103 722-755 — —			
Mineral Engineering with M.Tech in Material Technology									5761-6565 1824-1870
Mineral Engineering with M.Tech in Mineral Resource Management									5719-6652 1876-1882 — — —
Mining Engineering					4078-4337 1459-1570 773-773			5866-6288 1872-1909 — — —	6074-6542 1862-1910 — — —
Mining Engineering with MBA									5681-6045 1607-1906 —
Mining Engineering with M.Tech in Safety Engineering and Disaster Management in Mines					3970-4563 1574-1632 — — —				
Naval Architecture and Ocean Engineering						2832-3085 959-959 694-694 — —			
Naval Architecture and Ocean Engineering with M.Tech in Applied Mechanics in any of the listed specializations						2695-2910 896 611			
Ocean Engineering and Naval Architecture					2409-3341 1104-1226 443-832 —				
Petroleum Engineering with M.Tech in Petroleum Management									3992-5063 1057-1521 —
Physics (BS & MS)						1717-2681 386-572 599-669			
Process Engineering with MBA							2852-4237 1105-1650 —		

COURSE	IIT							
	BHUBANESWAR	GANDHINAGAR	HYDERABAD	INDORE	MANDI HP	PATNA	RAJASTHAN	ROPAR
	A	N	H	E	C	P	J	U
Four-year B.Tech. Courses								
Chemincal Engineering		2943-3741 1291-1572 752-940						
Civil Engineering	3425-4272 1123-1575 639-965							
Computer Science and Enginnering			1159-2357 531-760 142-376 23-143	1959-3627 711-1218 447-793	3118-3914 910-1363 465-838	3529-4299 916-1397 667-841	1963-3192 606-1127 371-578 —— 138-138(PD)	2604-3296 1016-1210 570-671
Electrical Engineering	2585-3704 948-1230 692-844	1939-3038 802-1158 79-795	985-2645 436-906 257-441 175-204 72-72(PD)	2502-3916 1284-1443 727-944	3547-4146 868-1504 544-891	3439-4313 1335-1584 826-951	2830-3555 661-1241 512-673 201-201	3293-3847 1077-1334 545-740
Mechanical Engineering	3147-4025 1025-1401 661-887 — 136-136 (PD)	1736-3317 794-1264 220-858	1812-2876 523-1008 390-528	3133-4060 825-1523 641-921 151-151 63-63(PD)	3185-4288 1326-1564 584-956	4097-4410 1430-1597 768-879	2947-3792 1020-1365 530-705	3336-4001 1242-1478 616-848

Note : In each cell, the first row gives the opening and closing ranks for GE candidates, the second row for OBC candidate, the third row for SC candidates, and the fourth row for ST candidates.

Table-3, DETAILS OF FEES (in Rupees)
The Fee structure for the Institute given below in indicative only

Fees in Institutes	One Time Payment	Payable Each Semester	Refundable Caution Deposit	Medical Insurane Premum Per Annum	Total Fees Payable at Admission
IIT Bhubaneswar	3800	28800 (3800)	6000	300	38900 (13900)
IIT Bombay	3400	33550 (8500)	3000	126	40076 (15076)
IIT Delhi	2500	27035 (2035)	4000	450	33985 (8985)
IIT Gandhinagar	3400	33550 (8550)	3000	126	40076 (15076)
IIT Guwahati	2150	28700 (3700)	4650	-	35500 (10500)
IIT Hyderabad	1750	27850 (2850)	2000	496	32096 (7096)
IIT Indore	3400	33550 (8550)	3000	126	40076 (15076)
IIT Kanpur	2150	34692 (9692)	7000	-	43842 (18842)
IIT Kharagpur	3100	28600 (3600)	6000	425	37625 (12625)
IIT Madras	1750	27850 (2850)	2000	496	32096 (7096)
IIT Mandi	2890	32750 (7750)	4000	280	39920 (14920)
IIT Patna	2150	28550 (3550)	4500		35200 (10200)
IIT Rajasthan	2150	30750 (5750)	4000	1000	37900 (12900)
IIT Ropar	2500	27035 (2035)	4000	450	33985 (8985)
IIT Roorkee	2890	32750 (7750)	4000	280	39920 (14920)
IT BHU Varanasi	3325	13960 (13960)	4000	-	21285 (21285)
ISM Dhanbad	6000	19492 (5192) (ODD) 17000(2700) (Even)	5000	-	30492 (16192)

Fees payable by SC/ST students, where different from those payable by others, are shown in parentheses ( ).

Annual Fee for foreign students – US $ 2000 + other charges in Indian Rupees (for SAARC countries)US $ 4000 + other charges in Indian Rupees (for other countries)

* In addition to these, mess admission fee/mess deposit and medical insurance premium may have to be paid.

\# This includes Rs 1800/- towards charges for blazer and tie.

\# \# The fee is for B.Tech. Programme which includes Tuition Fee of Rs. 14,000/- per semester. The tuition fee for 2nd Year onwards for 5 year Integrated

M.Sc. / M.Sc. Tech Programme will be Rs. 10,000/- per semester. The tuition fee for dual degree programme will be Rs. 14,000/- per semester for first fouryears and in 5th Year it will be Rs. 6,000/- for M.Tech. and Rs.20,000/- for MBA. The amount payable in odd and even semesters for these students in subsequent years will vary accordingly.

4.2 Aptitude Test for B.Arch./B.Des.

Candidates desirous of joining these courses (Courses 37 and 38 in **Section** 3) will be required to qualify in **Architecture/ Design Aptitude Test.** The test will be held on **Thursday, June 10, 2010** at all institutes where counselling is done**.** The test will be of three hours duration, from 10.00 am to 1.00 pm. Such candidates must have their JEE-2010 Admit Card with them to appear in the Aptitude Test. Candidates who fail to qualify in this Aptitude Test will not be eligible for admission to B.Des. or B.Arch. courses. Syllabus for the test is given below.

Syllabus:

Freehand drawing: This would comprise of simple drawing depicting the total object in its right form and proportion, surface texture, relative location and details of its component parts in appropriate scale. Common domestic or day-to-day life usable objects like furniture, equipment, etc., from memory.

Geometrical drawing: Exercises in geometrical drawing containing lines, angles, triangles, quadrilaterals, polygons, circles etc. Study of plan (top view), elevation (front or side views) of simple solid objects like prisms, cones, cylinders, cubes, splayed surface holders etc.

Three-dimensional perception: Understanding and appreciation of three-dimensional forms with building elements, colour, volume and orientation. Visualization through structuring objects in memory.

Imagination and aesthetic sensitivity: Composition exercise with given elements. Context mapping. Creativity check through innovative uncom-mon test with familiar objects. Sense of colour grouping or application.

Architectural awareness: General interest and awareness of famous ar-chitectural creations - both national and international, places and personali-ties (architects, designers etc.) in the related domain.

Candidates are advised to bring geometry box sets, pencils, erasers and colour pencils or crayons for the Aptitude Test.