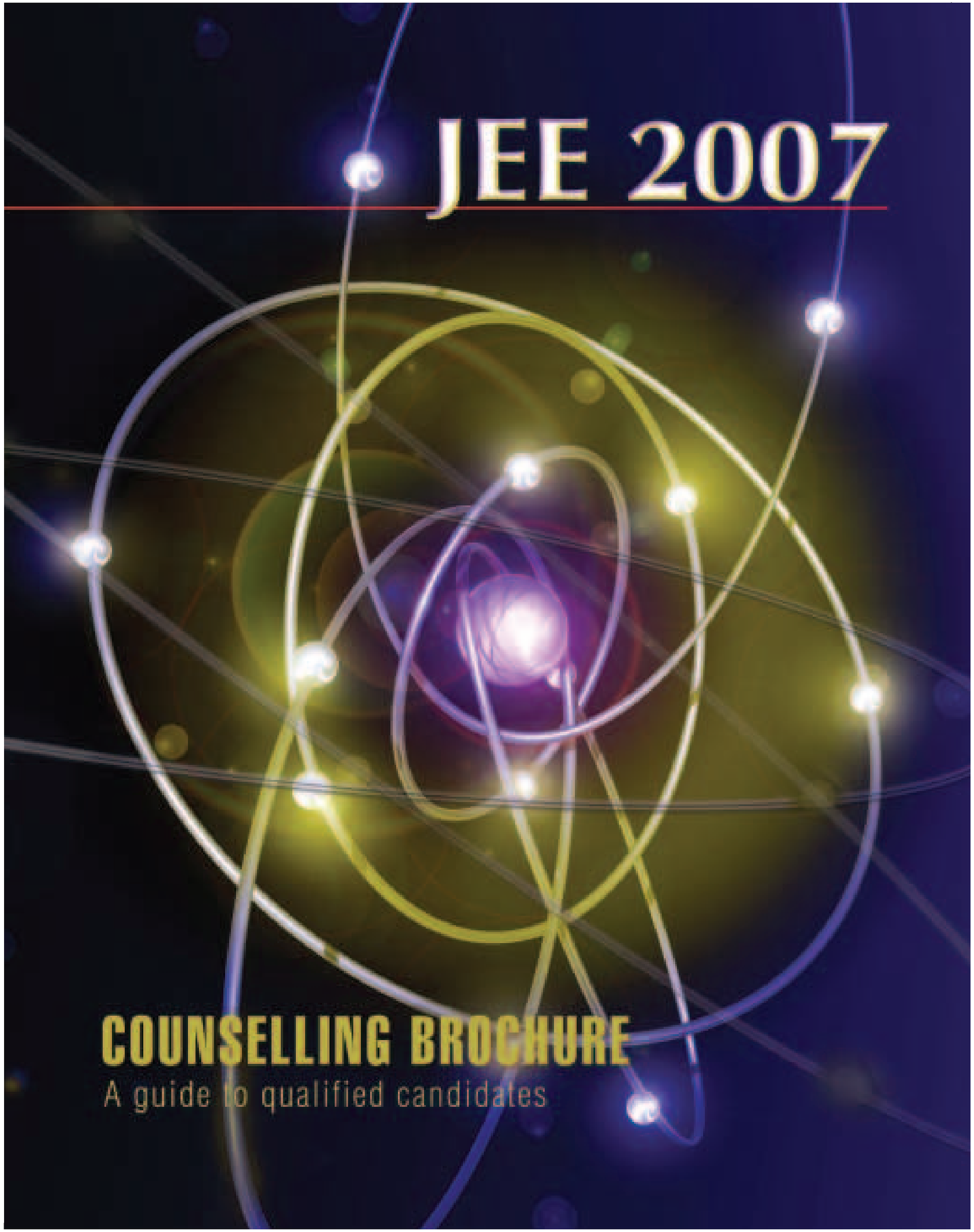
JEE 2007
COUNSELLING BROCHURE
A guide to qualified candidates

CONTENTS

CANDIDATES MUST BRING THE FOLLOWING FOR THE COUNSELLING SESSION:

1. Counselling Letter.
2. An account payee bank draft drawn in favour of Chairman, JEE of the Institute which issued the Admit Card (Rs. 8000 for SC/ST candidates and Rs.15000 for all other categories).
3. Admit Card of JEE-2007.
4. Original and two attested copies of a Certificate with your Date of Birth on it (usually the tenth class Board Certificate).
5. Original and two attested copies of the qualifying examination certificate and marks sheet. For the candidates who have appeared for their qualifying examination during 2007, in case the result of the same qualifying examination is not yet declared, a certificate from the Head of the School to this effect must be brought. The admission of such candidates is considered provisional. **All such provisionally admitted candidates must satisfy the eligibility criteria, listed under Section 7 of the Information Brochure for JEE-2007, on or before September 30, 2007. An undertaking (given in this brochure) must also be submitted by the provisionally admitted candidates.**
6. Application form for admission (given in this brochure), duly completed.
7. Medical Examination Report (form given in this brochure), duly signed by a Registered Medical Practitioner.
8. Original and two attested copies of the appropriate category certificate (SC/ST/DS), if applicable.

1. INTRODUCTION

Indian Institutes of Technology (IITs) are institutions of national importance established through an Act of Parliament. These Institutes play a leading role in technological manpower development and have excellent research programmes. Admissions to the undergraduate programmes at these institutions for all Indian and Foreign nationals are made through the Joint Entrance Examination (JEE).

The Institute of Technology, Banaras Hindu University (IT-BHU), Varanasi is one of the oldest institutions devoted to education in various engineering disciplines and Indian School of Mines University (ISMU), Dhanbad, is the oldest institution of its kind in India. Admissions to the undergraduate programmes at these institutions are also made through 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 well-equipped, modern laboratories, state-of-the-art computer networks, well-stocked library and access to digital library resources. Teaching methods rely on direct personal contact between the teacher and the students and the use of traditional and modern instructional techniques. Students live in a pleasant and intellectually stimulating environment which provides an exciting and unique experience.

These institutions offer courses leading to Bachelor's degree in a number of engineering, technological and scientific disciplines. Integrated M.Sc. courses in pure and applied sciences and integrated M.Tech. 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.

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.

The number of seats available in each Institute for various courses through JEE-2007 for various categories of students is given in **Table-1**.

2. VERIFICATION OF DOCUMENTS AND SUBMISSION OF CHOICE SHEET

It is mandatory for all successful candidates to attend the "Verification of Identity and Counselling" session in person. In case a candidate is unable to attend in person because of serious illness, he/she can authorize, in writing, his/her parent or guardian to attend the session as per schedule and fill-in the required forms on his/her behalf. In such a case, the parent/guardian must bring a medical certificate from a Registered Medical Practitioner stating that the candidate cannot attend the counselling session in person. In addition, the parent/guardian must bring all the required documents mentioned earlier.

The main purpose of asking candidates to appear in person is to verify their identity. **Hence, the candidates must bring their admit cards** and various documents for verifying identity, age, mark sheet of qualifying examination, and category, **all in original with two photocopies of each. The rules of eligibility for admission of candidates will be the same as that given in Section 7 of the Information Brochure.** The details of other documents required to be brought by the candidate are given on the inside front cover of this brochure. On failing to establish the authenticity of any of the above documents, the candidate will not be considered for admission. Candidates who qualify in the category of "Persons with Disability" (PD category) will have to appear before a special Medical Board at IIT Bombay.

After checking their identity and documents, the candidates will be asked to submit their choice-sheets for courses and institutes. The counselling brochure has been provided to help the candidates exercise their option judiciously. Some IIT faculty may also be available for consultation. Prior to appearing for counselling candidates are advised to visit the websites of the institutes for more detailed information.

After the qualified candidates have exercised their choice as per counselling schedule, seat allocation will be done centrally on a later date on the basis of All India Rank (AIR) and choices exercised by the candidates. There is no provision for instant seat allocation at the time of counselling.

The choices given by the candidates during the counselling session are final and cannot be changed at a later time. In their own interest candidates must fill in a sufficiently large number of choices of courses in the decreasing order of preference. As allotment is purely based on the AIR of the candidate and the order of choice of courses, a candidate who fills-in an insufficient number of choices may not be allotted a seat in any of the Institutes.

To take care of possible dropouts, the number of qualified candidates is more than the number of seats available in IITs, IT-BHU, Varanasi and ISMU Dhanbad. The fact that an applicant has qualified in JEE-2007 and has been called for identity verification and counselling does not guarantee admission to him/her. This will depend upon the applicant's AIR, his/her choice of courses/institutes and the number of seats.

Requests for changing the scheduled date of counselling will not be entertained. Under exceptional medical

requirements, a change of the place for the scheduled counselling may be permitted at the discretion of the Organizing Chairman. For such a change, a fee of Rs. 500/- (Rs. 250/- for SC/ST candidates) will be charged.

Candidates will not be paid any travelling or other allowances for attending this session. However, 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.

Candidates called for counselling may, wherever possible, be provided boarding and lodging facilities by the institutes on payment of charges.

Candidates must deposit Rs. 15000/- (Rs. 8000/- for SC/ST candidates) in the beginning of the counselling session. This includes a handling fee of Rs. 300/- (Rs. 200/- for SC/ST candidates). The balance of Rs. 14700/- (Rs. 7800/- for SC/ST candidates) will be adjusted towards fees of the first semester at the Institute where the candidate is offered admission. Those who are not offered admission for any course at any Institute according to their choices will be entitled to the refund of the balance amount. **However, those who do not join after an offer of admission has been made to them will not be entitled to any refund.**

As mentioned above, seats will be filled exclusively on the basis of All India Ranks (AIRs) of eligible candidates under each category, taking into account choices exercised by them. 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 this session. On the day of counselling only the duly filled-in choice sheet(s) are collected from the candidates.

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 5. **However, change of Institute is not allowed under any circumstance.**

The admitting Institute will dispatch "Letters of Admission" to the candidates by July 9, 2007. The seat allotment information will also be available on respective web sites of the IITs.

3. PHYSICAL FITNESS AND MEDICAL EXAMINATION

Each candidate must bring a Medical Examination Report from a registered medical practitioner, in the prescribed format given at the end of this brochure. Candidates will be admitted only if they are physically fit to pursue 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 to which admission is sought will be certified by a duly constituted Special Medical Board. **All PD candidates, irrespective of the zone from which they have qualified, must report for counselling at IIT Bombay at 8.00 AM on Monday, June 18, 2007 and appear before the Medical Board at IIT Bombay.**

Courses in Mining Engineering and Mining Machinery Engineering and related courses (Courses 27, 28 and 109, 110 and 111 of Table 1) have additional prescribed standards of fitness. The candidate 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 the better eye and 6/9 for the worse eye). Candidates with monocular (one-eyed) vision are also not eligible for adimission to these courses. In addition, candidates seeking admission to Petroleum Engineering related Courses and M. Sc. Tech. Applied Geology (Courses 31, 50, 115) should also be free from color blindness.

Candidates must make sure that they meet the require standards if they opt for these courses. The 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.

4. SPECIAL REQUIREMENTS FOR CERTAIN COURSES

Special requirements of certain course as mentioned in Table 1 are given below.

Courses 27, 28, 31, 50, 109, 110, 111 and 115 (Mining Engineering and Mining Machinery Engineering and related courses): Special medical requirements apply as given in Section 3. Further ISMU Dhanbad **does not** admit women candidates in the Mining Engineering, Mining Machinery Engineering and related courses (Courses 27, 28, 109 and 110). *Women candidates are eligible to opt for Mining Engineering at IIT Kharagpur and IT-BHU, provided they fulfill the special medical requirements mentioned in Section 3.* 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.".

Courses 36 and 37 (B.Des. and B.Arch.): The candidates desirous of joining these courses will be required to qualify in Architecture/Design Aptitude Test to be conducted at each counselling Institute on **Friday, June 22, 2007**. The test will consist of two papers each

of two hours duration, from 10.00 am to 12.00 noon and 2.00 pm to 4.00 pm. Such candidates must have their JEE-2007 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.

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

5. PARTICIPATING INSTITUTES

5.1 INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

IIT Bombay was established in the year 1958 with the cooperation and participation of the then Government of USSR under UNESCO's technical assistance programme and celebrates its Golden Jubilee in the year 2007-2008. Today the Institute is recognized as a centre of academic and research excellence, offering engineering, science, management and humanities education on par with the best in the world.

Located at Powai on the outskirts of the metropolitan city of Mumbai, the industrial and economic capital of India, the IIT campus extends over 500 acres of green, wooded land on the shores of Powai Lake. 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.

IIT Bombay offers a large number of undergraduate and postgraduate programmes in Engineering, Science, Management and Humanities. Departments, Schools, Centres and Interdisciplinary Groups constitute the academic fabric of the Institute. The Institute has well-equipped laboratories and workshops, excellent computer facilities in all the departments in addition to a central Computer Centre, and one of the finest technical libraries in the country. About 2000 students are on roll in the undergraduate programmes and 3200 in the postgraduate programmes. This includes a number of foreign students. The faculty strength is about 400.

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, 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 an 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 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 for in that semester and 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 he/she 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, publications and projects sponsored by the industry and national agencies.

To students admitted through JEE-2007, IIT Bombay offers the following undergraduate and post graduate programmes:

- **B.Tech.**
- **B.Tech. (Honours) or B.Tech. with 1 Minor,**
- **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 8 semesters spread over 4 years, and the Dual-Degree M. Tech. and Integrated M.Sc. Programmes consist of 10 semesters spread over 5 years. In the Dual-Degree M.Tech. Programme, a B.Tech. degree of the parent Department and an M.Tech. Degree in the specialization is given at the end of 5th 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/her basic B.Tech. programme. Similarly, "Honours" is awarded to students completing a prescribed set of courses and/or project in his/her own department. 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.

IIT Bombay continues to introduce new areas in its academic programme and innovation in its academic activities. The Kanwal Rekhi School of Information Technology, Shailesh J. Mehta School of Management, and the School of Biosciences and Bioengineering 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.

The IIT Bombay campus houses all the students and most of the faculty and staff. The Institute has thirteen students' hostels, which include the recently-added, two state-of-the-art hostels having accommodation for about 450 students each. There are two well-secured hostels for women students. Each hostel has modern amenities including a computer room, gym and 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 50-bed hospital, a pathology lab, dental care, radiology, sonography, physiotherapy, and an operation theatre. The hospital provide primary health care in the form of OPD and in-patient facilities.

A Student Activity Centre (SAC) provides excellent facilities for sports and cultural activities. Sports facilities include a swimming pool, tennis, badminton and squash courts and many 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. An Entrepreneurship Cell guides students and promote in them the spirit of entrepreneurship by organizing competitions, and lectures and workshops by eminent entrepreneurs. A business incubator 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 any 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% students of the total admitted students in that 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 $\geq$ 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
   (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%.
   (c) 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 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 .

5.2 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 a picturesque landscape and an imaginative lay out. 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, they interact, and 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 self-learning, project activity and laboratory work. It leaves sufficient time for students to take part in other activities such as 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. 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 obtained 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 $\geq$ 7.50
- CGPA for SC/ST and Person with Disability category students $\geq$ 6.50
- Earned credits at the end of the first academic session $\geq$ 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%, 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.

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.

5.3 INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

IIT Guwahati was established in 1994. The residential campus is spread over 700 acres of land on the north bank of the river Brahmaputra with a picturesque surrounding. The campus takes full advantage of the natural features of the terrain, which includes of several hillocks and lakes. The Brahmaputra flows majestically on one side while the other side has a backdrop of blue hills. The campus is about 20 km from Guwahati railway station and about 15 km from Guwahati airport.

An academic complex, five boys' hostels with a total of 1700 rooms, a girls' hostel with 168 rooms, a guest house with a capacity of 144, an administrative building and ample residential quarters have already been constructed in the campus. These cater to the requirements of classrooms, laboratories, hostels, and residences for faculty and staff. A well-equipped hospital run by a team of dedicated doctors takes care of the health and hygiene of the community. Each hostel has a mess, a canteen, indoor games facilities, cable TV, local area network (LAN) connection, and uninterrupted water and power supply. All students enjoy the privacy of a single room.

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.

Branches of Canara Bank and State Bank of India, a post office, a book shop, a shopping complex and several PCOs serve the needs of the campus residents.

Guwahati is the capital of the state of Assam. 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 ^{0}C and the minimum temperature in winter is around 7 ^{0}C. Guwahati, the gateway to the north eastern region of India, is well-connected by rail and by air to the rest of India.

Academic Programmes and Facilities

Undergraduate programmes offered include B.Tech. in nine disciplines, viz. Biotechnology, Chemical Engineering, Chemical Science and Technology, Civil Engineering, Computer Science and Engineering, Electronics and Communication Engineering, Engineering Physics, Mathematics and Computing, and Mechanical Engineering, and B.Des. in Design. Two-year M.Sc. programmes in Physics, Chemistry, and Mathematics and Computing are also offered. Postgraduate programmes offered include M.Tech., M.Des., and Ph.D. programmes. Departments of Chemistry, Mathematics, Physics, Humanities and Social Sciences cater to various core courses of B.Tech. and B.Des. programmes. 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 programme. The Computer Centre with its modern facilities and ambient 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 many journals online.

The ninth batch of B.Tech. students are graduating this year from IIT Guwahati. 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. graduates have obtained admissions to M.S. and Ph.D. programmes in universities abroad with scholarships.

Students' Activities

Students' activities are coordinated by the Student Gymkhana. "Alcheringa"—the annual Cultural Festival, and "Techniche"—the annual All India Science and Technology Exhibition-cum-Competition, are two major events organized by the students, which draw participation from various institutions and colleges. "Manthan", an inter-batch cultural competition, is held annually. The Institute has a SPICMACAY chapter through which a number of cultural programmes are arranged. Students bring out "Besides", a bi-annual magazine. "Natya Manjiri", a forum of students for dramatics, "Aileron", a literary forum, and "Cineaste", a film club, are active throughout the year. "Kiranankan" is the annual competition organized by the photography club. Apart from these, students arrange a number of intramural sports and cultural events throughout the year. Professional societies formed by students of individual departments arrange technical programmes for the benefit of students of the Institute and other institutions in the region.

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, and M.Sc. programmes consist of 4 semesters spread over two 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.

5.4 INDIAN INSTITUTE OF TECHNOLOGY KANPUR

IIT Kanpur is located just outside the major industrial town of Kanpur which is well-connected with all other metropolitan cities. Since its inception in 1960, the Institute is engaged in carrying out original research of significance and technology-development at the cutting-edge. It 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 cultivates freedom of thought, and vision, nurtures entrepreneurship, encourages growth, inculcates human values and concern for the environment and society.

IIT Kanpur is reputed all over the world for its innovative academic programmes that lay stress on science-based engineering education. IITK 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.

The Institute has a fully residential, beautiful and picturesque campus, spread over 1055 acres of land, with all modern amenities. It has about 2100 undergraduate and 1500 postgraduate students, more than 300 faculty members and 700 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. Equipped with a pharmacy, a clinical laboratory and a 30-bed indoor ward, the Health Centre provides medical help and emergency-care to the campus community round-the-clock.

The students are accommodated in eight boys' hostels and a girls' hostel. All rooms in the hostels have provisions for internet connectivity and connection to other computers through Local Area Network.

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-kilometre runway. The P K Kelkar Library of the Institute is one of the finest scientific and technological libraries in the country 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.

Through Media Lab Asia projects IIT Kanpur is pursuing many projects aimed at providing innovative solutions and tools for rural Indian masses. These projects include low-cost rural connectivity, mobile telecommunication and internet facilities. IIT Kanpur has developed strong facilities for online electronic classrooms where interactive classes are held for students in different centres across the country. Starting from the year 2005, the Institute has also embarked upon an ambitious Biological Sciences and Bioengineering programme.

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 in reducing 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 2 semesters instead of the normal 1 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.

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.

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, hall 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, Umang-the film festival, and Techkriti-the all India science and technology exhibition. These events draw participation from academic institutions all over country. In addition, students organize a large number of extracurricular events encompassing literary, cultural and spiritual 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.

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 2nd, 3rd and 4th 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, MSc.(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 as late as the 7th semester.
7. Relaxed eligibility criteria are adopted for students of SC/ST categories.

5.5 INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

The Indian Institute of Technology Kharagpur was founded in 1951. A forerunner of the other six IITs, and in many ways a role model for them, IIT Kharagpur has been producing scientists and technologists of the highest calibre 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.

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. This 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 services R&D and from alumni contributors. Some of these 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 and Space Technology Cell. A large new Computer and Informatics Centre, a new wing for Information Technology, computer network for halls of residence, students' hostels rooms and a spacious lecture hall complex are fully operational.

After the Golden Jubilee of IIT Kharagpur in 2001-2002 a number of mission projects of far-reaching importance are being implemented. A vibrant partnership between the alumni and the Institute with a worldwide network, has been actively supporting the Institute in many projects.

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

- 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.), 64 postgraduate (M.Tech., Dual Degree, M.C.P., M.B.M.) and research (M.S., Ph.D., D.Sc.) programmes.
- 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 an elaborate distance education programme offering a regular Postgraduate Diploma in Information Technology.
- The sponsored research and consultancy projects generate significant amount of fund.
- The Science and Technology Entrepreneurs' Park (STEP) of IIT Kharagpur has given a fillip to entrepreneurial activities in the region.

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.

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.

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. The aim is to encourage students towards conceptual, analytical and reasoning-based problem solving, where better students would be confronted with challenges providing opportunities of developing into creative individuals. 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.

New Management Programme

A five year dual degree programme – the first of its kind in the IIT system builds on the combined strengths of the Vinod Gupta School of Management and the Engineering departments of the IIT Kharagpur. It is designed to groom future leaders in business and technology equipping them with both technical knowledge and management skills. One of the objectives of this programme is to offer management education to top quality graduates of IIT Kharagpur by extending their stay on the campus, following a qualifying test, for an additional year. Thus the students will be well trained in technology, business management, innovative thinking and entrepreneurship, thereby sharpening their competitive edge in the national and international job market where all-round leaders in technology and management are always highly sought after.

In this Dual Degree programme, students are required to take 32 credits on management related subjects between third to eighth semesters of their B.Tech. programme. Out of 32 credits, 18-20 credits will be in lieu of their breadth electives and 14-16 credits will be extra. During the fifth year, students will be taking another 52 credits to complete the MBM requirement. Thereby the full curricula of both engineering and management will be maintained.

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 study to another after the first academic year (first two semesters). Only those students will be eligible for consideration for a change of branch who have

(a) completed all credit courses in the first two semesters in their first attempt.

(b) obtained a CGPA of not lower than a prescribed value at the end of the 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 a tie, it will be resolved by considering the JEE rank of the applicants.

(a) 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.

(b) The remaining eligible applicants shall be allowed a change of branch strictly in order of their inter-se merit, subject to the limitation that 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.

(c) 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.

5.6 INDIAN INSTITUTE OF TECHNOLOGY MADRAS

The Indian Institute of Technology Madras (IITM) is one of the finest, globally reputed technological institutions that has 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, M.Sc., M.S. , MBA and Ph.D. degrees through its technology, engineering, science, management, 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 a variety of flora and fauna, the campus of IITM 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 programs. Our workshops, laboratories, computing infrastructure, 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 wide 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 five-year dual degree (B.Tech+M.Tech) programmes consist of an amalgamation of core courses in the chosen engineering 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.

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 IIT M 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 students a great deal of freedom in choosing their electives and minor streams. The curriculum, pedagogy and the academic atmosphere together infuse in our students a strong spirit of inquiry, joys of learning and the excitement of knowledge discovery.

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. Change over 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 on 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 only ISO 9001 certified technical festival in our country.

The students also learn a lot from eminent personalities across various fields through the extramural Lectures organized frequently every semester.

Personality Development is also an integral part of education, and students at IIT Madras are presented with ample opportunities to develop into all round, mature, responsible individuals. Students can choose to pursue almost any interest be it quizzing, music, theatre, public speaking, creative writing, photography, trekking or sports. A medley 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 artistes make it an unforgettable experience for all.

'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 the Inter-IIT sports meet has often been won by IIT M. 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 any one of the NCC/NSO/NSS programmes for a year as apart of the B.Tech programme requirements.

Campus Facilities and Life at IIT M

The recent renovation of hostels has provided residents with not only extremely comfortable living conditions but also with 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 diverse tastes, a power laundry, 24 hour STD/ISD booths, ATM counters of various banks and an expansive Open Air Theatre in which movies are screened every week. In order to make the 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 IIT 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 industrial 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.

5.7 INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

IIT Roorkee is an Institute with a long and illustrious history. Roorkee College started in 1847 as the first Engineering College in South Asia. The institute was renamed as Thomason College of Civil Engineering in 1854 and was rechristened, in 1945, 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 3 centres of excellence (such as Nanotechnology, Disaster Management and Transportation Systems), 6 academic and service centres (such as Institute Computer Centre, Information Superhighway Centre, Instrumentation Centre) that offer 11 undergraduate courses in engineering and architecture, 5 Integrated dual degree courses and 62 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. Academic programmes in Paper Technology and Polymer Science and Technology are run at the Saharanpur Campus of IIT Roorkee. From the current year, a new 5-year Integrated Dual-Degree programme (Process Engineering) and M.B.A. have been started at the Saharanpur Campus. Further, three new 5 year integrated M.Sc. programs are also being started in Sciences at the main campus.

IIT Roorkee has a highly qualified and motivated faculty of about 380 who are strongly committed to teaching and research. It offers its expertise to private and public sector industries, and various Government agencies through consultancy services. The Institute plays a key role in the development of Uttranchal State and the nation at large. Some of its major ongoing 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 that 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 and 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.

The Institute has spacious classrooms with multi-media facilities and a modern, 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.

Students 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-acre 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 acre 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.

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 exchange 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. Activities such as 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, in all its UG, 5-year dual degree, and PG programmes, modern methods of continuous evaluation through a credit system. 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 credit system follows letter-grades on a 10-points scale where performance is measured in terms weighted grade-point-average (SGPA and CGPA). A student has to satisfy minimum CGPA 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). Located 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 through Joint Entrance Examination (JEE), is eligible for change of branch/programme at the end of first year provided he/she satisfies the following criteria:

1. (i) CGPA for general category students $\geq$ 7.5
   (ii) CGPA for SC/ST category students $\geq$ 6.5
   (iii) Earned credits at the end of 1st year $\geq$ 50*
   * The credits for NCC/NSS/NSO/Rangering, proficiency and discipline shall not be counted for this purpose.
2. While permitting 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, 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.

5.8 INSTITUTE OF TECHNOLOGY, BANARAS HINDU UNIVERSITY, VARANASI

The institute of Technology is an integrated part of the Banaras Hindu University - an internationally established and renowned seat of learning.

The University

Banaras Hindu University was founded in the year 1916 by the great visionary and patriot, Pandit Madan Mohan Malviya. 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, the Institute of Technology, the Institute of Medical Sciences and the Institute of Agricultural Sciences, and fifteen Faculties. The 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 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 Pharmaceutics 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 B.Tech., M.Tech. and Ph.D. programmes. The Institute has a highly qualified and motivated faculty of over 220. Besides teaching, faculty members are also engaged in research and consultancy. The students are also encouraged to do projects under the able guidance of faculty members. 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 Programme

The Institute has well equipped laboratories and workshops and 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 to several journals is also possible. All students are provided with textbook bank facilities where a certain number of books are issued to them for a full semester.

IT-BHU follows a semester system. An academic year (July-May) consists of two semesters, each of approximately 20 weeks duration. The odd (first) semester begins in the third week of July and ends in the first week of December. The even (second) 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 per week. Each course is coordinated by a coordination committee, which has full responsibility for coordinating the course, holding 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 number of scholarships are awarded to the undergraduate students. Merit-cum-Means Scholarship 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.

Training & Placement

The Training and Placement Cell of the Institute coordinates the placement of students in various industries/organizations and arranges summer practical training. Placement track record of the institute has been excellent with students getting on an average 1.5 jobs with salary packets between Rs. 2.1 lacs p.a. to Rs. 8.5 lacs p.a. Approximately 60-80 organizations visit the campus for recruitment. In this process almost all the students get placed in reputed organizations through campus selection. The graduates of the Institute occupy top positions in leading industries, educational institutions and R & D organizations in India and abroad. Every year a large number of students go abroad for higher education in reputed universities. A few students also join management courses.

Practical training is an essential component of the curricula. This inculcates professional culture among students and familiarizes them to the work-environment of Indian industries. Students are also encouraged to go abroad for their practical training.

Hostel & Health Care

The Institute has nine hostels for boys and two for girls. All the hostels are equipped with modern amenities. The messes are 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 treatment, 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 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 and indoor stadiums. Gymkhana activities are mainly managed by the students, encourage artistic and creative talent in

dramatics, elocution, music and visual arts. The Gymkhana has various active clubs, viz. HAM, Audio, Photography, Automobile and Aeromodelling, 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:

The Institute permits certain number of students to change from one branch of study to another after the first academic year, as per the following rules:

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.

5.9 INDIAN SCHOOL OF MINES UNIVERSITY DHANBAD

Indian School of Mines University (ISMU) 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 provide manpower to the Indian mineral industry and the concerned departments of the Government. Subsequently, in 1958, Department of Petroleum Engineering and Applied Geophysics were also added. In due recognition of its vital role in the service of the mineral exploration and mining sectors of the national economy, the School 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.

The School is situated about 3 km north of Dhanbad Railway Station on the Grand Chord of Eastern Railway. The serene campus, which covers an area of about 88 hectares, comprises academic buildings, students' hostels, and faculty and staff quarters as also other infrastructural facilities for a cosmopolitan community. The locational advantage of ISMU at Dhanbad is that it is situated at the centre of the major coal mining industry of the country.

ISMU offers admission through JEE to nine B.Tech. (4-year) programmes (Computer Science and Engineering, Electrical Engineering, Environmental Engineering, Electronics Engineering, Mechanical Engineering, Mineral Engineering, Mining Engineering, Mining Machinery Engineering, and Petroleum Engineering); five M Tech Dual Degree (5-year) programmes (Mineral Engineering with M Tech in Material Technology, Mineral Engineering with M Tech in Mineral Resource Management, Mining Engineering with M Tech in Mining Engineering, Mining engineering with MBA, Petroleum Engineering with M Tech in Petroleum Management); 3 M Sc Integrated (5-year) programmes (Applied Physics, Chemistry and Mathematics and Computing) and 2 M Sc Tech Integrated (5-year) programmes (Applied Geology and Applied Geophysics).

The School also runs 3-year M.Sc. Tech. programmes in Applied Geology and Applied Geophysics, 2-year M.Sc. programmes in Applied Geology, Mathematics and Computing, through separate all India competitive examinations. ISMU also has a 2-year M.B.A. Programme, the admission to which is made through CAT.

Since 1972, ISMU has also been running, number of industry-oriented M.Tech. and M.Phil. programmes. The Ph.D. programmes in engineering and sciences also attract many postgraduate students.

ISMU has a state-of-the-art Computer Centre, Computer Aided Mine Planning and Design (CAMPAD) Laboratory, and a highly specialized Central Library. Internet facility is provided in departments, laboratories, library and hostels. International Internet Gateway has been installed at ISMU with present bandwidth of 4 Mbps. An Experimental-cum-Training mine, at No.26 incline Godhur Colliery of BCCL, is a unique instructional facility of this institute.

ISMU is proud of its alumni. ISMU alumni hold top positions in all spheres of mineral, coal and petroleum industries. They also hold top positions in government offices connected with mineral, coal and petroleum.

The B.Tech. graduates get jobs in mineral, coal, petroleum, electronics and manufacturing industries and hardware/software and IT companies, through campus interviews.

There is a Training and Placement cell headed by a Professor who co-ordinates placements in reputed organizations through campus interviews.

Medical facilities at the health centre/hospitals of the School are provided to all students during their period of study at the School. Each hospital is well staffed and equipped with facilities for treatment of both indoor and outdoor patients.

Foreign Nationals offered admission will have to undergo medical examination as per Government of India rules. On arrival and prior to hostel accommodation, they will be provided guest house accommodation till the mandatory medical examination is completed.

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 have obtained at least 7.5 overall GPA out of 10.0 considering first and second semesters. For SC/ST and PD students GPA requirement will be 6.5 and above.
2. Students should not have passed any semester through special examination.
3. A student can apply for a change to any branch.
4. Change will be made strictly as per merit.
5. 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. After making the change, it should be ensured that the strength of the class should not fall below 50% of the sanctioned strength of any branch.
6. Students with GPA more than 9.2 considering first and second semesters will be permitted to change branch as per their choice even if they are not permitted by rule 5 above.

6. CODES FOR VARIOUS COURSES AND AVAILABILITY OF SEATS

Table 1 (page 44) 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 B01. Below the code of each course, the number of seats available in that course for the categories GE, SC, ST and PD, respectively, are given.

Table 2 (page 50) provides the opening and closing All India Ranks of the *previous year* for various courses (except for those added this year). 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.

7. SCOPE AND DESCRIPTION OF COURSES

Excellent opportunities exist for 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.

7.1 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 BIOENGINEERING

A new B.Tech. program in biological sciences and bioengineering (BSBE) at IIT Kanpur has been introduced 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, bioengineering 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, ans 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, Bioprocess Principles, and Downstream Processing.

Given the fast growing Biotechnology industry in India, this program trains graduates to be successful in challenging careers in the arrears 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, Biochemical 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 6^{th} to 8^{th} 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 brics, blocks, monolithics and 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 20^{th} 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 as 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 2007. 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 nanoscience, 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 ISMU 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. 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.

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 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. The Good employment opportunities for Engineering Physics graduates exist in universities and in research and development sections of national laboratories and industries.

17. 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, ISMU Dhanbad has conceptualized a four year B. Tech. Course in Environmental Engineering.

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, Environmental Policies, Legislation, Issues, Treaties, Protocols 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.

18. 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

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
ISMU 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

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.

19. 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.

20. MANUFACTURING SCIENCE AND ENGINEERING

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

21. 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 he/she choice.

22. 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.

23. 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.

24. 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.

25. 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, alongwith 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.

26. MINERAL ENGINEERING

A four-year B.Tech. Programme in Mineral Engineering, the first of its kind in India, is being offered by ISMU 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.

27. MINING ENGINEERING

Mining Engineering, a 4-year B.Tech. programme at IIT Kharagpur, IT BHU Varanasi and ISMU 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 demand of the industry.

28. 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. ISMU 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.

29. 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. 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. 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.

30. 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.

31. PETROLEUM ENGINEERING

Indian School of Mines University Dhanbad is the only recognized institute offering B.Tech. degree in Petroleum Engineering in India. Course structure was initially developed by representatives of ONGC, ISMU, 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.

32. 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.

33. 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.

34. TEXTILE TECHNOLOGY

A textile technologist is concerned with the transformation of textile fibres into yarns and fabrics, and their chemical processing. The programme covers extensively the processes and the mechanics involved in the production of polymers and their conversion into fibres, yarns and finished fabrics. During the undergraduate programme leading to B. Tech. degree in Textile Technology, students do courses in basic sciences, engineering arts and sciences, humanities, social sciences and management, in addition to the professional courses in the area of Textile Technology. Core textile courses cover fibre science, yarn manufacture, fabric manufacture, textile chemical processing, textile testing and design of textile products and processes. The domain of technical textiles for innovative applications is the most interesting aspects of the textile education in the department. Some of the immerging areas in textile department are in the field of medical textiles, smart textiles, comfort textiles, geotextiles, aerospace textiles, nanotextiles and nanoprocessing. The development of the innovative fibres, either by modification of the existing materials with desired characteristics or by designing of a polymer prior to its transformation into a desired fibre, is the attractive aspect of this programme. From fifth semester onwards, students choose elective from a wide variety of textile courses and can specialize in a particular area of textile technology by taking electives in that area. In the final year, they are required to work on a project on thrust areas like clothing physiology and comfort,

environment management, innovative materials, product and process development, apparel engineering and technology under the supervision of a faculty member. They also undergo practical training in a textile company as a part of their engineering education.

7.2 FOUR-YEAR B.PHARM. COURSE

35. 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, Pharmacokinetics, Pharmaceutical Management, Microbiology, 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).

7.3 FOUR-YEAR B.DES. COURSE

36. 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 undertaken give the student 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.

The first three batches of design students have graduated from the program in the year 2002, 2003 and 2004. A majority of them have opted for higher studies in design amongst 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.

7.4 FIVE-YEAR B.ARCH. COURSE

37. ARCHITECTURE

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).

7.5 FIVE-YEAR M.PHARM. DUAL DEGREE COURSE

38. 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.

7.6 FIVE-YEAR M.SC. INTEGRATED COURSES

39. 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 provides 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 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 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.

40. 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 thetraining in software tools which will equip them better to compete for GATE/NET and take research as a carreer.The programme will also enable the students to compete better in the job market in the software industry.

41. 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 Seismology, 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 School. They are also to take part in co-curricular activities in all the even semester. 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.

42. 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.

43. 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, biotechnology 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.

44. 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.

45. INDUSTRIAL CHEMISTRY

In keeping pace with the present global industrial scenario, this five-year integrated M. Sc. course in Industrial Chemistry aims at satisfying newer demands of academia and industries. The programme is a unique blend of the fundamentals of chemical concepts and their applications to diverse areas in engineering and life sciences. It provides an adequate background of graduate level mathematics, physics, and applications of computer and information technology to basic chemical and engineering problems. It also provides basic inputs in chemistry-allied disciplines such as drugs and pharmaceuticals, agrochemicals, environmental sciences and high-tech materials.

With such wide background and a solid foundation in chemistry and its applications, the graduates will have diverse job opportunities in the production and R&D departments in private and public sector organizations, in industries producing bulk and fine chemicals, polymer products, and advanced electronic and engineering materials. The course also provides ample opportunities for entering into graduate level programme leading to Ph.D. in any academic institution, both in India and abroad.

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 endeavor, 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 he/she 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.

49. STATISTICS AND INFORMATICS

The role of Statistics as the technology of data analysis and decision making under uncertainty has expanded vastly in the past few years due to advances taking place in Computer Science and Information Technology. Statisticians, especially those able to exploit modern computational techniques and facilities, are very much in demand in industry, commerce, and scientific organizations. Hence, a course of this nature is a need of the hour.

This 5-year integrated M.Sc. course in Statistics and Informatics is the first of its kind in the country. The

purpose of this course is primarily to prepare the students with in-depth knowledge of various branches of Statistics together with applications using modern tools of Computer Science and Information Technology. The program imparts necessary knowledge of Statistical inference, Time series and forecasting methods, Stochastic processes, Regression analysis, Multivariate analysis, Design of experiments, Sampling methodologies, etc. The course also gives them strong foundation in various areas of computer Science and information Technology such as design and analysis of algorithms, Computer organization and operating systems, Information and coding theory, Networks, Internet and web based technologies, Database management systems. Data warehousing and data mining etc. Through a suitable choice of electives, a student can specialize in one or two selected areas. Besides, the students have to complete three projects as part of the curriculum.

Employment opportunities are available in various companies dealing with IT, Finance, Bioinformatics, Medical informatics or in research and development organizations. The course is also designed to prepare students for advanced research work at the Ph.D level, which in turn prepares them for teaching and research careers in Statistics, Information Technology, and Computer Science in industry, government, or academia.

7.7 FIVE-YEAR M.SC. TECH INTEGRATED COURSE

50. APPLIED GEOLOGY

The Department of Applied Geology of Indian School of Mines University, 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 nation's mineral exploration and development programmes. The Department hosts well-quipped laboratories and the state-of-art analytical facilities for training and advanced research in the filed 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 ISMU. (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 programmes 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 excellend job opportunity with leading oil companies in India and abroad.

7.8 FIVE-YEAR M.TECH. INTEGRATED COURSE

52. APPLIED GEOLOGY

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. APPLIED GEOPHYSICS

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 e 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.

7.9 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 4th 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 4th year and extend through the 5th 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.

IIT Bombay offers the following four specializations in the dual degree programme: Aerodynamics; Aerospace Propulsion; Aerospace Structures; and Dynamics and Control. Initially, the students are admitted to Aerospace Engineering program. Choice of specialization is to be made at the end of 6th semester. The award of M.Tech. specialization is based on satisfying requirements in terms of specialization electives. In case these requirements are not satisfied, M.Tech. degree in Aerospace Engineering without specialization will be awarded.

59. AEROSPACE 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 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 instrumentation, 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 Dualdegree programme. A comprehensive coverage of all essential aspects of Agricultural & Food Engineering will be provided in the first three years. A dual dgree students has the flexibility to opt for anyone of the following M.Tech. specializations based on his/her own choise and performance at the end of the third year:

(i) Farm Machinery and 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 and 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 a 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, Biochemistry, 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 5th year in still 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 3rd year. It lays down the foundation of knowledge for processing, manufacturing and characterization of whole range of ceramic materials and products. During 4th and 5th 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 Kharagpur, Kanpur 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, 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 COMPUTER APPLICATIONS IN CHEMICAL ENGINEERING

Computers have revolutionized chemical industry due to application of computer aided design and simulation, computer process dynamics and control, computational fluid dynamics, artificial intelligence (AI) and neural networks. On a computer monitor, one can design, simulate, visualize and analyze a chemical plant using software without actually working in a real chemical plant, or pilot plant. Use of computers in chemical industry has enormously improved the accuracy of designing, costing, and controlling the process parameters, has reduced the time requirement for feasibility report preparation, and has introduced versatility in project implementation. Experts in above fields with fundamentals of chemical engineering knowledge are in great demand in job market of chemical and software industries.

In this programme, a student will take fundamental and application oriented courses, such as computer aided design, modeling and simulation in chemical engineering, intelligent and knowledge based systems, advanced computational techniques in chemical engineering, application of simulation languages, computer process control, application of AI and ANN in chemical engineering, computational fluid dynamics, apart from B.Tech. chemical engineering courses. Many of these courses will have an associated laboratory component. The student will have an advanced level research project to fulfill the requirement of degree.

69. 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 risen 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 an 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 arrangements with the National Research Laboratories and the user hydrocarbon industries/organizations. The student undergoing this programme shall have enough opportunities for placement.

70. CHEMICAL ENGINEERING WITH M.TECH. IN PROCESS ENGINEERING AND DESIGN/ CHEMICAL ENGINEERING WITH M.TECH. IN PROCESS SYSTEMS DESIGN AND ENGINEERING

The present day competitive environment requires modern chemical plants, petrochemical complexes, and petroleum refineries to operate at high levels of productivity, efficiency, capacity utilization, process and environment safety, and energy conservation. It has therefore become inevitable for chemical engineers to apply the concepts of Process System Engineering to generate flexible and cost effective designs and be competitive in operation. This specialization has been designed with its prime focus on an integrated systems approach to Process Design and Engineering.

Advanced courses in the programme will enable the students to acquire adequate knowledge and develop skills in key areas of Process System Design and Engineering such as Process Synthesis, Simulation and Design, Optimization, Control, Safety and Energy Integration. The students will have opportunities to work with, modern computer-based tools (software packages) to solve large-scale problems of reasonable complexity.

The graduates of this programme will have ample employment opportunities in consultancy and design organizations and other companies using modern tools of automation for their production units. In addition, they would be very well suited for doctoral programmes and careers in Research and Development.

71. CIVIL ENGINEERING

The aim of this dual degree program at IIIT 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.

72. 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 7th semester.

With 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.

73. CIVIL ENGINEERING WITH SPECIALIZATION IN INFRASTRUCTURAL ENGINEERING IN M.TECH.

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 infrastructure 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, 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.

74. 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 scientists and professional civil engineers.

75. 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.

76. 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 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.

77. 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. The Information Technology scenario in India is at its peak and the objective is to make India an IT super power by the year 2008.

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, Telecommunication, 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.

78. 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.

79. 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. With 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.

80. 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.

81. ELECTRICAL ENGINEERING WITH SPECIALIZATION IN COMMUNICATION ENGINEERING IN M.TECH.

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.

82. 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.

83. 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.

84. ELECTRICAL ENGINEERING WITH SPECIALIZATION IN MICROELECTRONICS AND VLSI DESIGN IN M.TECH.

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.

85. 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 6th 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 7th 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.

86. 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.

87. ELECTRICAL ENGINEERING WITH SPECIALIZATION IN POWER SYSTEMS AND POWER ELECTRONICS IN M.TECH.

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, there by honing the skills of the students for a bright future in Power Engineering.

88. 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 2007 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

89. 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-12 (page 17), 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.

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

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 speicalization in Automotive Engineering. Specializations 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 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 various kinds 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.

92. 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.

93. MANUFACTURING SCIENCE AND ENGINEERING WITH M.TECH. IN INDUSTRIAL ENGINEERING 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.

94. MATERIALS SCIENCE AND TECHNOLOGY

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.

95. 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.

96. 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.

97. 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.

98. MECHANICAL ENGINEERING WITH SPECIALIZATION IN ENERGY TECHNOLOGY IN M.TECH.

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.

99. MECHANICAL ENGINEERING WITH SPECIALIZATION IN INTELLIGENT MANUFACTURING IN M.TECH.

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.

100. MECHANICAL ENGINEERING WITH SPECIALIZATION IN PRODUCT DESIGN IN M.TECH.

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.

101. 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.

102. MECHANICAL ENGINEERING WITH M.TECH. IN THERMAL AND FLUIDS ENGINEERING

Thermal and Fluids Engineering is the basis of Power Generation, Vehicular Transportation, Refrigeration, Air-conditioning, Fluid Handling, etc.

The objective of this dual degree course is an in-depth coverage of fundamental subjects like thermodynamics, fluid dynamics, heat transfer, combustion, and their application to fluid machinery, refrigeration, air-conditioning, cryogenics, thermal energy conversion devices like IC engines and gas and steam turbines. Substantial exposure to computational, analytical and experimental techniques is envisaged.

With rapid growth in transportation, power generation and space technology in India, this programme is expected to provide exciting career opportunities.

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 ENGINEERING/ 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 MATERIALS 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 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 ISMU 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 fundamental 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, environmental management, 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 Indian School of Mines University, Dhanbad. It builds on the combined strengths of the Department of Mining Engineering and Department of Management Studies of ISMU. The program is designed to groom future leaders in business and technology, equipping term 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 ISMU 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, IIT Kharagpur 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, 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 exist 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 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 7th semester.

Basic knowledge in Naval Architecture with a specialized knowledge in the area of Solid Mechanics (or) Fluid Mechanics provide 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 5th semester the subjects taught are common and 6th 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.

8. 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.

SYLLABUS FOR APTITUDE TEST FOR B.ARCH./B.DES.

(To be held on Friday, June 22, 2007)

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 uncommon test with familiar objects. Sense of colour grouping or application.

Architectural awareness: General interest and awareness of famous architectural creations – both national and international, places and personalities (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.

Table 1: CODES FOR VARIOUS COURSES AND AVAILABILITY OF SEATS

(seat availability is shown as per MHRD notification dated April 27, 2007)

	COURSE				IIT				IT-BHU	ISMU
		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	B01 16+3+2; (1)			K01 19+4+2; (1)	G01 16+3+2; (1)	M01 19+3+1; (1)			
2	Agricultural and Food Engineering					G02 17+3+2; (1)				
3	Biological Sciences and Bioengineering				K03 20+4+2; (1)					
4	Biotechnology			W04 27+5+3; (1)			M04 23+4+2; (1)	R04 24+5+2; (1)		
5	Biotechnology and Biochemical Engineering					G05 14+3+2; (1)				
6	Ceramic Engineering								V06 30+6+2; (1)	
7	Chemical Engineering	B07 49+9+5; (2)	D07 36+7+3; (1)	W07 31+6+3; (1)	K07 31+6+3; (1)	G07 26+5+2; (1)	M07 37+7+4; (2)	R07 28+5+3; (1)	V07 60+11+6; (2)	
8	Chemical Science and Technology			W08 15+3+2; (1)						
9	Civil Engineering	B09 39+8+4; (1)	D09 55+12+5; (2)	W09 38+8+4; (2)	K09 41+8+4; (2)	G09 31+6+3; (1)	M09 32+7+4; (1)	R09 61+11+5; (2)	V09 40+8+4; (1)	
10	Computer Science and Engineering	B10 28+5+2; (1)	D10 32+6+3; (1)	W10 37+7+4; (1)	K10 26+5+3; (1)	G10 28+6+3; (1)	M10 15+3+2; (1)	R10 24+5+2; (1)	V10 30+5+3; (1)	S10 47+9+5; (2)
11	Electrical Engineering	B11 30+6+3; (1)	D11 32+6+3; (1)		K11 50+10+5; (2)	G11 28+5+3; (1)	M11 32+7+3; (2)	R11 60+11+6; (2)	V11 40+8+4; (1)	S11 47+9+4; (2)
12	Electrical Engineering (Power)		D12 16+3+2; (1)							
13	Electronics Engineering								V13 40+8+4; (1)	S13 47+9+5; (2)
14	Electronics and Communication Engineering			W14 37+7+4; (1)				R14 28+5+3; (1)		
15	Electronics and Electrical Communication Engineering					G15 31+6+3; (1)				
16	Engineering Physics	B16 16+3+2; (1)	D16 32+6+3; (1)	W16 15+3+2; (1)			M16 12+2+1; (1)			
17	Environmental Engineering									S17 31+6+3; (1)
18	Industrial Engineering					G18 15+3+1; (1)				
19	Instrumentation Engineering					G19 16+3+2; (1)				
20	Manufacturing Science and Engineering					G20 15+3+2; (1)				
21	Materials and Metallurgical Engineering				K21 47+9+5; (2)					
	Metallurgical and Materials Engineering					G21 22+4+2; (1)	M21 20+4+2; (1)	R21 49+9+4; (2)		
22	Mathematics and Computing			W22 15+3+2; (1)						
23	Mechanical Engineering	B23 36+7+3; (1)	D23 52+10+5;(2)	W23 42+8+4; (2)	K23 37+7+4;(1)	G23 34+7+3; (1)	M23 38+8+4; (2)	R23 39+8+4; (1)	V23 50+10+5; (1)	S23 52+10+5; (2)

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
24	Metallurgical Engineering								V24 35+7+3; (1)	
25	Metallurgical Engineering and Materials Science	B25 36+7+3; (1)								
26	Mineral Engineering**									S26 30+6+3;(1)
27	Mining Engineering**					G27 20+4+2; (1)			V27 50+10+5; (1)	S27 60+12+6;(0)
28	Mining Machinery Engineering**									S28 20+3+2; (0)
29	Naval Architecture and Ocean Engineering						M29 18+3+1; (1)			
30	Ocean Engineering and Naval Architecture					G30 17+3+2; (1)				
31	Petroleum Engineering**									S31 52+10+5; (0)
32	Production and Industrial Engineering		D32 24+5+2; (1)					R32 24+5+2; (1)		
33	Pulp and Paper Engineering							R33 54+11+5; (2)		
34	Textile Technology		D34 47+9+6; (2)							
	Four-year B.Pharm. Course									
35	Pharmaceutics								V35 18+3+2; (1)	
	Four-year B.Des. Course									
36	Design**			W36 23+5+2; (1)						
	Five-year B.Arch. Courses									
37	Architecture**					G37 25+5+2; (1)		R37 40+7+4; (1)		
	Five-year M.Pharm. Dual Degree Course									
38	Pharmaceutics								V38 10+2+1; (1)	
	Five-year M.Sc. Integrated Courses									
39	Applied Geology					G39 18+3+1; (1)				
40	Applied Mathematics							R40 15+3+2; (1)		
41	Applied Physics									S41 16+3+1; (2)
42	Chemistry	B42 18+4+2; (1)			K42 14+3+1; (1)			R42 15+3+2; (1)		S42 16+3+1; (2)
43	Economics				K43 19+4+2; (1)	G43 22+4+2; (1)				
44	Exploration Geophysics					G44 17+3+2; (1)				
45	Industrial Chemistry					G45 17+3+2; (1)				
46	Mathematics and Computing					G46 17+3+2; (1)				S46 16+3+1; (2)

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
47	Mathematics and Scientific Computing				K47 25+5+2; (1)					
48	Physics				K48 14+3+1; (1)	G48 18+3+1; (1)		R48 15+3+2; (1)		
49	Statistics and Informatics					G49 22+4+2; (1)				
Five-year M.Sc.Tech. Integrated Courses										
50	Applied Geology**									S50 15+3+2; (1)
51	Applied Geophysics									S51 16+3+1; (1)
Five-year M.Tech. Integrated Courses										
52	Applied Geology							R52 15+3+2; (1)		
53	Applied Geophysics							R53 15+3+2; (1)		
54	Engineering Physics								V54 10+2+1; (1)	
55	Industrial Chemistry								V55 10+2+1; (1)	
56	Mathematics and Computing		D56 24+5+2; (1)						V56 10+2+1; (1)	
57	Polymer Science and Technology							R57 15+3+2; (1)		
Five-year M.Tech. Dual Degree Courses										
58	Aerospace Engineering	B58 16+3+2; (1)			K58 5+1+1; (1)	G58 9+2+1; (1)	M58 7+2+1; (1)			
59	Aerospace Engineering with Mtech in Applied Mechanics with specialization in Biomedical Engineering						M59 4+0+1; (1)			
60	Agricultural and Food Engineering with M.Tech. in any of the listed specializations*					G60 16+3+1; (1)				
61	Biochemical Engineering								V61 10+2+1; (1)	
62	Biochemical Engineering and Biotechnology		D62 24+5+2; (1)							
63	Bioengineering with M.Tech. in Biomedical Technology								V63 10+2+1; (1)	
64	Biotechnology						M64 12+2+1; (1)			
65	Biotechnology and Biochemical Engineering					G65 12+2+1; (1)				
66	Ceramic Engineering								V66 10+2+1; (1)	
67	Chemical Engineering				K67 8+1+1; (1)	G67 13+3+1; (1)	M67 9+2+1; (1)			
68	Chemical Engineering with M.Tech. in Computer Applications in Chemical Engineering		D68 13+2+1; (1)							
69	Chemical Engineering with M.Tech. in Hydrocarbon Engineering							R69 13+2+1; (1)		

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
70	Chemical Engineering with M.Tech. in Process Engineering and Design		D70 13+2+1; (1)							
	Chemical Engineering with M.Tech. in Process Systems Design and Engineering	B70 16+3+2; (1)								
71	Civil Engineering				K71 12+2+1; (1)					
72	Civil Engineering with M.Tech. in Applied Mechanics in any of the listed specializations						M72 4+1+0; (1)			
73	Civil Engineering with specialization in Infrastructural Engineering in M.Tech.						M73 14+3+1; (1)			
74	Civil Engineering with M.Tech. in Structural Engineering	B74 21+4+2; (1)							V74 10+2+1; (1)	
75	Civil Engineering with M.Tech. in any of the listed specializations*					G75 10+2+1; (1)				
76	Computer Science and Engineering	B76 16+3+2; (1)	D76 16+3+2; (1)		K76 20+4+2; (1)	G76 19+4+2; (1)	M76 13+2+1; (1)		V76 8+1+1; (1)	
77	Computer Science and Engineering with M.Tech. in Information Technology							R77 13+2+1; (1)		
78	Electrical Engineering				K78 16+3+2; (1)					
79	Electrical Engineering with M.Tech. in Applied Mechanics with specialization in Biomedical Engineering						M79 3+1+1; (1)			
80	Electrical Engineering with M.Tech. in Communications and Signal Processing	B80 16+3+2; (1)								
81	Electrical Engineering with specialization in Communication Engineering in M.Tech.						M81 12+2+1; (1)			
82	Electrical Engineering with M.Tech. in Information and Communication Technology		D82 13+2+1; (1)							
83	Electrical Engineering with M.Tech. in Microelectronics	B83 16+3+2; (1)								
84	Electrical Engineering with specialization in Microelectronics and VLSI Design in M.Tech.						M84 12+2+1; (1)			
85	Electrical Engineering with M.Tech. in any of the listed specializations*					G85 12+2+1; (1)				
86	Electrical Engineering with M.Tech. in Power Electronics							R86 7+2+1; (1)	V86 10+2+1; (1)	
87	Electrical Engineering with specialization in Power Systems and Power Electronics in M.Tech.						M87 7+2+1; (1)			
88	Electronics and Communication Engineering with M.Tech. in Wireless Communication							R88 8+2+1; (1)		
89	Electronics and Electrical Communication Engineering with M.Tech. in in any of the listed specializations*					G89 19+4+2; (1)				
90	Engineering Design with specialization in Automotive Engineering in M.Tech.						M90 23+4+2; (1)			

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
91	Engineering Physics with M.Tech. in Engineering Physics with specialization in Nanoscience	B91 6+1+1; (1)								
92	Industrial Engineering with M.Tech. in Industrial Engineering and Management					G92 13+3+1; (1)				
93	Manufacturing Science and Engineering with M.Tech. in Industrial Engineering and Management					G93 9+2+1; (1)				
94	Materials Science and Technology								V94 10+2+1; (1)	
95	Mechanical Engineering				K95 13+3+1; (1)				V95 10+2+1; (1)	
96	Mechanical Engineering with M.Tech. in Computer Aided Design and Automation	B96 13+2+1; (1)								
97	Mechanical Engineering with M.Tech. in Computer Integrated Manufacturing (CIM)	B97 12+2+1; (1)								
98	Mechanical Engineering with specialization in Energy Technology in M.Tech.						M98 12+2+1; (1)			
99	Mechanical Engineering with specialization in Intelligent Manufacturing in M.Tech.						M99 12+2+1; (1)			
100	Mechanical Engineering with specialization in Product Design in M.Tech.						M100 12+2+1; (1)			
101	Mechanical Engineering with M.Tech. in any of the listed specializations*					G101 23+4+2; (1)				
102	Mechanical Engineering with M.Tech. in Thermal and Fluids Engineering	B102 12+2+1; (1)								
103	Metallurgical Engineering								V103 10+2+1; (1)	
104	Metallurgical Engineering and Materials Science with M.Tech. in Ceramics and Composites	B104 16+3+2; (1)								
105	Metallurgical Engineering and Materials Science with M.Tech. in Metallurgical Process Engineering	B105 16+3+2; (1)								
	Metallurgical and Materials Engineering						M105 7+2+1; (1)			
106	Metallurgical and Materials Engineering with M.Tech. in Metallurgical and Materials Engineering					G106 9+2+1; (1)				
107	Mineral Engineering with M.Tech. in Materials Technology									S107 9+2+1; (1)
108	Mineral Engineering with M.Tech. in Mineral resource Management									S108 9+2+1; (1)
109	Mining Engineering **					G109 9+2+1; (1)			V109 10+2+1; (1)	S109 9+2+1; (0)
110	Mining Engineering with MBA**									S110 9+2+1; (0)

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
111	Mining Engineering with M.Tech. in Safety Engineering and Disaster Management in Mines**					G111 8+2+1; (1)				
112	Naval Architecture and Ocean Engineering						M112 5+1+1; (1)			
113	Naval Architecture Engineering with M.Tech. in Applied Mechanics in any of the listed specializations						M113 4+1+0; (1)			
114	Ocean Engineering and Naval Architecture					G114 10+2+1; (1)				
115	Petroleum Engineering with M.Tech. in Petroleum Management**									S115 9+2+1; (0)
116	Process Engineering with MBA							R116 15+3+2;(1)		
	TOTAL GE+SC+ST; (PD)	444+84+ 46; (17)	429+83+ 41; (17)	280+55+ 30; (11)	417+82+ 42; (16)	677+131+ 66; (27)	418+81+ 41; (16)	577+111+ 58; (22)	531+103+ 52; (25)	510+99+ 49; (20)
	TOTAL all categories	574	553	365	541	874	540	746	686	658

* The 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 on page 2.

Notes:

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

For PD category 3% of the seats will be reserved in each course, subject to a minimum of one seat in each course, with a sealing of 3% for each Institute. Seats allotted to PD candidates will be adjusted against their respective category.

The data given in the above table 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.

The total number of seats available in all Institutes including IT-BHU and ISMU Dhanbad through JEE-2007 in different categories are given below.

Category	GE	SC	ST	TOTAL*
Seats	4283	829	425	5537

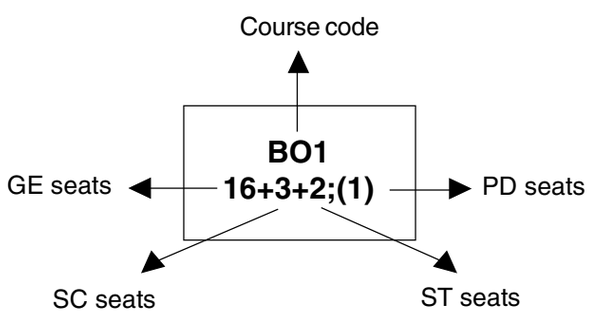

Table 2: OPENING AND CLOSING RANKS OF GE, SC AND ST CANDIDATES (JEE-2006)

	COURSE				IIT				IT-BHU	ISMU
		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	0439-1278 0140-0224 0061-0117			0755-1470 0087-0236 0110-0124	1533-1836 0243-0261 0035-0065	0929-1669 0201-0274 0118-0118			
2	Agricultural and Food Engineering					2629-3090 0453-0612 -------				
3	Biological Sciences and Bioengineering				1008-2105 0294-0415 0130-0130					
4	Biotechnology			2740-3028 0391-0517 -------			0905-2163 0221-0351 0121-0121	1952-2826 0392-0483 -------		
5	Biotechnology and Biochemical Engineering					1625-2272 0341-0435 -------				
6	Ceramic Engineering								3586-4492 ------- -------	
7	Chemical Engineering	0196-1004 0121-0258 0076-0133	0740-1143 0183-0255 0078-0142	2192-2760 0336-0404 -------	0786-1268 0249-0279 0127-0153	1209-1688 0278-0293 -------	0915-1555 0295-0319 0131-0146	1665-2087 0292-0332 -------	3172-3505 0625-0698 -------	
8	Chemical Science and Technology			NewCourse						
9	Civil Engineering	1047-1874 0252-0420 0111-0138	1266-2002 0103-0369 0070-0155	2672-3127 0477-0530 -------	1106-2279 0275-0396 -------	2014-2587 0409-0466 0151-0151	1938-2365 0327-0467 -------	2198-2764 0322-0474 -------	3316-3925 0550-0677 -------	
10	Computer Science and Engineering	0002-0064 0005-0016 0001-0004	0001-0111 0008-0027 0003-0007	0804-1181 0152-0208 0092-0120	0010-0130 0012-0029 0011-0016	0136-0368 0032-0058 0009-0027	0074-0187 0011-0038 0013-0022	0389-0681 0062-0080 0049-0073	1028-2111 0244-0333 0093-0136	3078-4146 0305-0633 -------
11	Electrical Engineering	0005-0126 0001-0052 0005-0020	0119-0197 0003-0047 0012-0019		0106-0308 0054-0112 0024-0038	0430-0727 0060-0127 0032-0057	0022-0399 0077-0133 0029-0050	0728-1420 0117-0220 0043-0098	2585-3008 0401-0565 -------	4132-4564 0648-0673 --------
12	Electrical Engineering (Power)		0543-0939 0122-0179 0040-0048							
13	Electronics Engineering								1703-2570 0337-0484 -------	3155-4285 0598-0696 -------
14	Electronics and Communication Engineering			0608-1482 0194-0248 0135-0135				0504-0895 0006-0104 0036-0055		
15	Electronics and Electrical Communication Engineering					0144-0477 0041-0088 0002-0031				
16	Engineering Physics	0025-1058 0135-0309 0132-0132	0091-1631 0317-0397 -------	1345-2608 0459-0492 -------			0733-1226 0373-0393 0147-0147			
17	Environmental Engineering									4733-5328 ------- -------
18	Industrial Engineering					1663-1919 0310-0406 -------				
19	Instrumentation Engineering					0833-1275 0262-0272 0102-0102				
20	Manufacturing Science and Engineering					1396-1684 0363-0402 -------				

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
21	Materials and Metallurgical Engineering				1803-2473 0433-0546 -------					
	Metallurgical and Materials Engineering					2173-2598 0580-0610 -------	1997-2525 0557-0596 -------	2664-2976 0548-0631 -------		
22	Mathematics and Computing			0670-2063 0308-0500 -------						
23	Mechanical Engineering	0255-0527 0035-0120 0023-0056	0271-0677 0072-0139 0015-0066	1559-2100 0193-0291 0134-0134	0082-0741 0115-0147 0068-0075	0559-1041 0095-0185 0071-0097	0277-0921 0148-0189 0077-0099	1310-1627 0167-0234 0103-0116	2421-3219 0536-0585 -------	3477-4722 0579-0663 -------
24	Metallurgical Engineering								3307-4041 0664-0664 -------	
25	Metallurgical Engineering and Materials Science	1400-1979 0358-0492 0090-0090								
26	Mineral Engineering									4594-5407 ------- -------
27	Mining Engineering					3002-3262 0638-0644 0109-0109			4035-4913 ------- -------	4290-5318 0588-0588 -------
28	Mining Machinery Engineering									4807-5384 ------- -------
29	Naval Architecture and Ocean Engineering						2182-2824 0506-0583 -------			
30	Ocean Engineering and Naval Architecture					2527-2841 0512-0561 -------				
31	Petroleum Engineering									2844-4051 0560-0691 -------
32	Production and Industrial Engineering		0793-1234 0218-0339 0094-0094					1720-2322 0441-0465 -------		
33	Pulp and Paper Engineering							3151-4103 0658-0700 -------		
34	Textile Technology		1660-2740 0468-0576 -------							
Four-year B.Pharm. Course										
35	Pharmaceutics								4765-5488 0534-0534 -------	
Four-year B.Des. Course										
36	Design			3381-4424 0615-0615 0114-0114						
Five-year B.Arch. Courses										
37	Architecture					2519-4997 ------- -------		3515-5515 ------- -------		
Five-year M.Pharm. Dual Degree Course										
38	Pharmaceutics								4513-5471 ------- -------	

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
Five-year M.Sc. Integrated Courses										
39	Applied Geology					3593-3950				
40	Applied Mathematics							New Course		
41	Applied Physics									4831-5525
42	Chemistry	2891-3430 0604-0684		3800-4171	3107-3648			New Course		5047-5510
43	Economics				2822-3321	3258-3667				
44	Exploration Geophysics					3034-3569 0672-0683				
45	Industrial Chemistry					3510-3777				
46	Mathematics and Computing					2001-2687 0529-0630				4553-4907
47	Mathematics and Scientific Computing				0577-2859 0539-0697					
48	Physics				0444-2883 0356-0653	2901-3480 0607-0699		New Course		
49	Statistics and Informatics					2753-3254				
Five-year M.Sc. Tech. Integrated Courses										
50	Applied Geology									5190-5500
51	Applied Geophysics									4555-5512
Five-year M.Tech. Integrated Courses										
52	Applied Geology							New Course		
53	Applied Geophysics							New Course		
54	Engineering Physics								3183-3625	
55	Industrial Chemistry								4206-4400	
56	Mathematics and Computing		0481-0891 0239-0405 0128-0128						3184-3350 0567-0567	
57	Polymer Science and Technology							2906-3452		
Five-year M.Tech. Dual Degree Courses										
58	Aerospace Engineering	0698-1581 0082-0276 0140-0143			1237-1657 0075-0075 0145-0145	1834-1978 0171-0230	1698-1850 0303-0304 0154-0154			
59	Aerospace Engineering with M.Tech. in Applied Mechanics with specialization in Biomedical Engineering						New Course			

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
60	Agricultural and Food Engineering with M.Tech. in any of the listed specializations					3103-3302 0642-0654 -------				
61	Biochemical Engineering								3552-4177 ------- -------	
62	Biochemical Engineering and Biotechnology		0851-2246 0376-0446 -------							
63	Bioengineering with M.Tech in Biomedical Technology								3568-4189 0678-0686 -------	
64	Biotechnology						1156-2387 0371-0430 -------			
65	Biotechnology and Biochemical Engineering					2291-2524 0501-0510 -------				
66	Ceramic Engineering								4300-4636 ------- -------	
67	Chemical Engineering				1369-1652 0307-0344 -------	1790-2051 0368-0408 -------	1578-1929 0352-0353 -------			
68	Chemical Engineering with M.Tech. in Computer Applications in Chemical Engineering		1287-1385 0299-0331 -------							
69	Chemical Engineering with M.Tech. in Hydrocarbon Engineering							1910-2474 0407-0440 -------		
70	Chemical Engineering with M.Tech. in Process Engineering and Design		1432-1662 0389-0395 -------							
	Chemical Engineering with M.Tech. in Process Systems Design and Engineering	1009-1285 0318-0416 -------								
71	Civil Engineering				2321-2564 0443-0499 0062-0062					
72	Civil Engineering with M.Tech. in Applied Mechanics with any of the listed specializations						New Course			
73	Civil Engineering with specialization in Infrastructural Engineering in M.Tech.						1302-2747 0448-0522 -------			
74	Civil Engineering with M.Tech. in Structural Engineering	1593-2290 0427-0480 -------							3485-4058 ------- -------	
75	Civil Engineering with M.Tech in any of the listed specializations*					2287-2770 0524-0526 -------				
76	Computer Science and Engineering	0108-0225 0030-0051 0042-0044	0204-0314 0057-0073 0051-0053		0221-0373 0046-0081 0059-0079	0409-0552 0097-0141 0083-0089	0145-0441 0068-0092 0039-0039		1499-2622 0419-0419 -------	
77	Computer Science and Engineering with M.Tech. in Information Technology							0877-1005 0106-0157 0091-0091		
78	Electrical Engineering				0428-0532 0151-0156 0082-0100					
79	Electrical Engineering with M.Tech in Applied Mechanics with specialization in Biomedical Engineering						New Course			
80	Electrical Engineering with M.Tech. in Communications and Signal Processing	0161-0438 0083-0102 0052-0060								

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
81	Electrical Engineering with specialization in Communication Engineering in M.Tech.						0465-0778 0150-0191 0122-0122			
82	Electrical Engineering with M.Tech. in Information and Communication Technology		0245-0415 0128-0149 0064-0064							
83	Electrical Engineering with M.Tech. in Microelectronics	0165-0341 0044-0096 0021-0028								
84	Electrical Engineering with specialization in Microelectronics and VLSI Design in M.Tech.						0510-0672 0155-0199 0084-0084			
85	Electrical Engineering with M.Tech. in any of the listed specializations*					0832-1086 0205-0211 0096-0096				
86	Electrical Engineering with M.Tech. in Power Electronics							New Course	2746-3160 0489-0611 -------	
87	Electrical Engineering with specializations in Power Systems and Power Electronics in M.Tech.						0787-1211 0214-0229 0125-0125			
88	Electronics and Communication Engineering with M.Tech. in Wireless Communication							0951-1056 0196-0245 0123-0123		
89	Electronics and Electrical Communication Engineering with M.Tech. in any of the listed specializations*					0512-0815 0159-0186 0054-0080				
90	Engineering Design with specialization in Automotive Engineering in M.Tech.						1110-2217 0388-0464 -------			
91	Engineering Physics with M.Tech. in Engineering Physics with specialization in Nanoscience	0937-1277 0323-0323 -------								
92	Industrial Engineering with M.Tech. in Industrial Engineering and Management					1984-2307 0328-0429 -------				
93	Manufacturing Science and Engineering with M.Tech. in Industrial Engineering and Management					1693-2112 0365-0422 -------				
94	Materials Science and Technology								4087-4429 ------- -------	
95	Mechanical Engineering				0185-1040 0207-0212 0119-0119				2865-3295 0507-0614 -------	
96	Mechanical Engineering with M.Tech. in Computer Aided Design and Automation	0567-0720 0036-0162 0086-0086								
97	Mechanical Engineering with M.Tech. in Computer Integrated Manufacturing (CIM)	0738-0875 0168-0178 0101-0101								
98	Mechanical Engineering with M.Tech. in Energy Technology						1242-1564 0247-0280 0149-0149			
99	Mechanical Engineering with specialization in Intelligent Manufacturing in M.Tech.						0987-1200 0231-0289 0152-0152			
100	Mechanical Engineering with specialization in Product design in M.Tech.						1206-1428 0284-0287 -------			
101	Mechanical Engineering with M.Tech. in any of the listed specializations*					1091-1633 0136-0238 0139-0148				

	COURSE				IIT				IT-BHU	ISMU
		BOMBAY	DELHI	GUWAHATI	KANPUR	KHARAGPUR	MADRAS	ROORKEE	VARANASI	DHANBAD
		B	D	W	K	G	M	R	V	S
102	Mechanical Engineering with M.Tech. in Thermal and Fluids Engineering	0879-1101 0188-0222 0144-0144								
103	Metallurgical Engineering								4067-4339 ------- -------	
104	Metallurgical Engineering and Materials Science with M.Tech. in Ceramics and Composites	1988-2338 0439-0569 -------								
105	Metallurgical Engineering and Materials Science with M.Tech. in Metallurgical Process Engineering	2340-2543 0578-0590 -------								
	Metallurgical and Materials Engineering						2676-2799 0597-0633 -------			
106	Metallurgical and Materials Engineering with M.Tech. in Metallurgical and Materials Engineering					2602-2779 0606-0635 -------				
107	Mineral Engineering with M.Tech in Materials Technology									4902- 5436 ------- -------
108	Mineral Engineering with M.Tech in Mineral resource Management									5000-5459 ------- -------
109	Mining Engineering					3270-3453 ------- -------			4313-5015 ------- -------	5030-5414 ------- -------
110	Mining Engineering with MBA									4394-4900 ------- -------
111	Mining Engineering with M.Tech in Safety Engineering and Disaster Management in Mines					3312-3504 ------- -------				
112	Naval Architecture and Ocean Engineering						2360-2899 0351-0351 -------			
113	Naval Architecture Engineering with M.Tech in Applied Mechanics in any of the listed specializations						New Course			
114	Ocean Engineering and Naval Architecture					2870-3049 0267-0571 -------				
115	Petroleum Engineering with M.Tech in Petroleum Management									3389-4141 0584-0602 -------
116	Process Engineering with MBA							New Course		

Note: In each cell (columns 3-11), the first row gives the opening and closing ranks for GE candidates, the second row gives the same for SC candidates, and the third row for ST candidates. The data are based on JEE-2006 results.

JEE-2007

SAMPLE FILLED - IN CHOICE SHEET

for Admission to Courses at

INDIAN INSTITUTES OF TECHNOLOGY

Bombay • Delhi • Guwahati • Kanpur • Kharagpur • Madras • Roorkee

IT-BHU Varanasi and ISMU Dhanbad

ALL INDIA RANK	JEE-2007 REGISTRATION NO.	CATEGORY GE/SC/ST	PD (Y/N)	DS (Y/N)	SEX M/F	COLOUR BLIND OR MONOOCULAR (Yes/No)
529	5041010	SC	Y	N	F	No

Full Name (in Capital Letters)

BHARATI BHUSAN

1.	K09	23.		45.		67.		89.	
2.	D09	24.		46.		68.		90.	
3.	B09	25.		47.		69.		91.	
4.	G09	26.		48.		70.		92.	
5.	M09	27.		49.		71.		93.	
6.	B10	28.		50.		72.		94.	
7.	D10	29.		51.		73.		95.	
8.	K10	30.		52.		74.		96.	
9.	K03	31.		53.		75.		97.	
10.	K43	32.		54.		76.		98.	
11.	G05	33.		55.		77.		99.	
12.	R10	34.		56.		78.		100.	
13.	R12	35.		57.		79.		101.	
14.	G09	36.		58.		80.		102.	
15.	W09	37.		59.		81.		103.	
16.	B07	38.		60.		82.		104.	
17.	M07	39.		61.		83.		105.	
18.	X	40.		62.		84.		106.	
19.		41.		63.		85.		107.	
20.		42.		64.		86.		108.	
21.		43.		65.		87.		Tick here if you are	
22.		44.		66.		88.		using additional sheets	

Write '**X**' at the end of your list of choices.

Date: **Signature of the Candidate**

Notes:

- Candidates may fill up as many choices as they wish. More than one Choice Sheet may be used if needed.
- No change in the options given by the candidate in the Choice Sheet will be permitted.
- The candidate will be offered admission to a Course in an Institute based on his/her All India Rank, subject to the availability of seats, as per the order of preference given in his/her Choice Sheet. Refer to Section 2 of this Brochure for details.
- The candidate will be given a computer printout of the choices made by him/her. Please verify carefully and sign on the computer printout before leaving the counselling session.
- Please ensure that all the special requirements listed in Section 4 of this brochure, if applicable, are fulfilled. The responsibility of ensuring the same rests entirely with the candidate. If the candidate opts and is allotted any of these courses and is later found to have violated the special requirements, his/her admission will be cancelled and no other course will be allotted to the candidate in any of the Institutes.

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JEE-2007

APPLICATION FORM FOR ADMISSION
INDIAN INSTITUTES OF TECHNOLOGY
Bombay • Delhi • Guwahati • Kanpur • Kharagpur • Madras • Roorkee
IT-BHU Varanasi and ISMU Dhanbad

1. JEE-2007 Regn. No. _____ 2. All India Rank _____

3. JEE-2007 Application No. _____ 13.Nationality (Indian/Non-Indian) _____

5. Category (GE/ SC/ST) _____ DS _____ PD _____

PASTE YOUR RECENT PHOTOGRAPH HERE

6. Applicant's Name_____

7. Date of Birth: _____ 8. Sex: _____

9. Parent's/Guardian's Name _____

10. Permanent Address

_____

_____

_____

Pin Code: _____

11. Address for Communication

_____

_____

_____

Pin Code: _____

12. Academic Qualifications

Examination	School/College	Board/University	Year of Passing	Percentage of Marks
10 th Class				
10+2 Class/ Intermediate				
Any other public examination				

13. Are you colour blind or uniocular? Yes No

14. Declaration:

I hereby declare that the particulars stated above are true to the best of my knowledge and belief. In the event of suppression or distortion of any fact, I understand that my admission/degree acquired is liable to be cancellation. I also understand that the decision of the Joint Admission Board regarding my admission to IITs/ IT-BHU Varanasi /ISMU Dhanbad is final and I shall abide by the rules and norms of the discipline of the Institute which I join.

_____ _____

Left Thumb Impression of the Candidate Signature of the Candidate

Place : _____

Date : _____ Countersignature of Parent/Guardian: _____

JEE-2007

VERIFICATION FORM

(To be completed by JEE staff)

1. DRAFT NO. _____BANK _____ AMOUNT: **Rs. 15000/-** or **Rs. 8000/-**

2. ADMIT CARD ☐

3. COUNSELLING LETTER ☐

4. TWO ATTESTED COPIES OF THE CERTIFICATE OF DATE OF BIRTH ☐
   (verified against the original)

5. TWO ATTESTED COPIES OF THE QUALIFYING EXAMINATION ☐
   CERTIFICATE AND MARK SHEET *(verified against the original)*

6. TWO ATTESTED COPIES OF THE SC/ST/DS/PD CATEGORY CERTIFICATE(S), ☐
   IF APPLICABLE *(verified against the original)*

7. MEDICAL EXAMINATION REPORT ☐

(Tick whichever is applicable.)

Checked documents 2 and 3 above. Also, collected items 1, 4, 5, 6(if applicable) and 7 above. ☐

Verification is Provisional. Reason: _____ ☐
_____

_____

Signature of JEE Official

JEE-2007

MEDICAL EXAMINATION REPORT

(To be issued by a Registered Medical Practitioner)

GENERAL EXPECTATIONS

Candidates should have good general physique. In particular,

a) Chest Measurement should not be less than 70 cm, with satisfactory limits of expansion and contraction.

b) Vision should be normal. In case of defective vision, it should be corrected to 6/9 in both eyes or 6/6 in the bettereye. Colour blind or uniocular persons are ineligible for admission in Mining Engineering and Mining Machinery Engineering courses.

c) Hearing should be normal. Defective hearing should be corrected.

d) Heart and lungs should not have any abnormality and there should be no history of mental illness or epileptic fits.

PERSONAL HISTORY

1. Name .....

2. JEE-2007 Registration No. .....

3. All India Rank .....

4. Parent/Guardian's Name .....

5. Age ..... Years .....Months

6. Sex .....

7. Identification Mark on the Body, if any .....
   (This can be a mole, scar or birthmark)

8. Major illness / operation, if any .....
   (Specify nature of illness / operation)

MEDICAL CERTIFICATE

(The following are to be filled by the Medical Officer conducting the medical examination)

1. Height .....cm
2. Weight .....kg
3. Past History
   a) Mental Disease .....
   b) Epileptic Fit .....
4. Chest
   a) Inspiration .....cm
   b) Expiration ..... cm
5. Blood Group .....
6. Hearing .....

7. Vision with or without glasses

   a) Right Eye ..... b) Left Eye.....

   c) Colour Blindness ..... d) Uniocular Vision.....

8. Respiratory system ..... 9. Nervous system .....

10. Heart 11. Abdomen

    a) Sounds ..... a) Liver.....

    b) Murmur ..... b) Spleen.....

12. a) Hernia .....

    b) Hydrocele ....

13. Any other defects .....

Certified that .....
son/daughter of .....

a) fulfills the prescribed standard of physical fitness and is FIT for admission to Engineering / Architecture / Pharmaceutics / Science course

b) does not fulfill the prescribed standard of physical fitness and is unfit / temporarily unfit for admission due to following defects

Signature of the Medical Officer **Signature of the Candidate**

Date .....

Full Name .....

Medical Registration No. .....

Official Seal

JEE-2007
INDIAN INSTITUTES OF TECHNOLOGY
Bombay • Delhi • Guwahati • Kanpur • Kharagpur • Madras • Roorkee
IT-BHU Varanasi and ISMU Dhanbad

UNDERTAKING

(To be given by a candidate whose qualifying examination result is awaited and hence provisionally admitted.)

1. Name
2. JEE-2007 Regn. No.
3. All India Rank
4. Category

I understand that my admission to any of the IITs/IT-BHU, Varanasi/ISMU Dhanbad is provisional since I have not submitted the original and two attested copies of the qualifying examination certificate and/or mark sheet as per the eligibility criteria stated in **Section 7 of the Information Brochure for JEE-2007.**

I also understand that in the event of my failing to fulfill the eligibility criteria **on or before September 30, 2007,** my provisional admission to any of the IITs/IT-BHU, Varanasi/ISMU Dhanbad will **stand cancelled.**

_____ _____

Left Thumb Impression of the Candidate **Signature of the Candidate**

Place: _____

Date: _____ Countersigned by Parent / Guardian _____

JEE-2007
CHOICE SHEET
for Admission to Courses at
INDIAN INSTITUTES OF TECHNOLOGY
Bombay • Delhi • Guwahati • Kanpur • Kharagpur • Madras • Roorkee
IT-BHU Varanasi and ISMU Dhanbad

ALL INDIA RANK	JEE-2007 REGISTRATION NO.	CATEGORY GE/SC/ST	PD (Y/N)	DS (Y/N)	SEX M/F	COLOUR BLIND OR MONOOCULAR (Yes/No)

Full Name (in Capital Letters)

1.		23.		45.		67.		89.	
2.		24.		46.		68.		90.	
3.		25.		47.		69.		91.	
4.		26.		48.		70.		92.	
5.		27.		49.		71.		93.	
6.		28.		50.		72.		94.	
7.		29.		51.		73.		95.	
8.		30.		52.		74.		96.	
9.		31.		53.		75.		97.	
10.		32.		54.		76.		98.	
11.		33.		55.		77.		99.	
12.		34.		56.		78.		100.	
13.		35.		57.		79.		101.	
14.		36.		58.		80.		102.	
15.		37.		59.		81.		103.	
16.		38.		60.		82.		104.	
17.		39.		61.		83.		105.	
18.		40.		62.		84.		106.	
19.		41.		63.		85.		107.	
20.		42.		64.		86.		108.	
21.		43.		65.		87.		Tick here if you are using additional sheets	
22.		44.		66.		88.			

Write '**X**' at the end of your list of choices.

Date: **Signature of the Candidate**

Notes:

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DETAILS OF FEES (in Rupees)

INDIAN INSTITUTES OF TECHNOLOGY							
	Bombay	Delhi	Guwahati	Kanpur	Kharagpur	Madras	Roorkee
One time payment	1525	2500	2150	2150	2300	1750	1690
Payable every semester	17950 †(4450)	15535 (2035)	16650 (1650)	18892 (5392)	15600 (2100)	16650 (3150)	16350 (2850)
Refundable caution deposit	3000	4000	4000	4000	4000	2000	4000
Medical insurance premium (per annum)	126				696	468	280
Total fees payable at the time of admission*	22601 †(9101)	22035 (8535)	22800 (7800)	25042 (11542)	22596 (9096)	20868 (7368)	22320 (8820)

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)

	IT-BHU Varanasi	ISMU Dhanbad
One time payment	3325	4200
Payable every odd semester	13910	#19550 (5250)
Payable every even semester	13910	#17000 (2700)
Refundable caution deposit	4000	5000
Total fees payable at the time of admission	21235	##28750 (14450)

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

* In addition to these, Rs. 750 fee for new hostel for girls, mess admission fee/mess deposit and medical insurance premium may have to be paid.

The fee is for B.Tech. Program 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. Program will be Rs 10,000/- per semester. The tuition fee for dual degree program will be Rs 14,000 per semester for first four years 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.

In addition to these, an additional fee of Rs. 1800 is to be paid towards cost of blazer and tie.

Websites of Institutes and JEE Telephone Numbers

Institute	Website	Telephone	IVRS	FAX
IIT Bombay	http://www.iitb.ac.in	022-25764063	022-25767062	022-25720305
IIT Delhi	http://www.iitd.ac.in	011-26591785	011-26581064, 011-26582002	011-26581067
IIT Guwahati	http://www.iitg.ac.in	0361-2692795, 0361-2582180	0361-2692788	0361-2692795
IIT Kanpur	http://www.iitk.ac.in	0512-2597335	0512-2597236	0512-2590103
IIT Kharagpur	http://www.iitkgp.ernet.in	03222-282101	03222-281881, 03222-278241	03222-255605
IIT Madras	http://www.iitm.ac.in	044-22578220	044-22578223	044-22578224
IIT Roorkee	http://www.iitr.ac.in	01332-285224, 01332-276469	01332-279805, 01332-279806	01332-285346
ISMU Dhanbad	http://www.ISMUdhanbad.ac.in	0326-2200023	—	0326-2200023
IT-BHU	http://www.itbhu.ac.in	0542-2307003	—	0542-2368428

COUNSELLING SCHEDULE

PD Candidates*	All Ranks	Monday	June 18, 2007
SC/ST/DS Candidates	All Ranks		
GE Candidates	All India Ranks 0001 – 0800	Tuesday	June 19, 2007
GE Candidates	All India Ranks 0801 – 2000	Wednesday	June 20, 2007
GE Candidates	All India Ranks 2001 – 3500	Thursday	June 21, 2007
GE Candidates	All India Ranks 3501 onwards	Friday	June 22, 2007
Candidates for Preparatory Course		Friday	July 06, 2007

*** Counselling and Medical Examination of all PD candidates will be only held at IIT Bombay.**

OTHER SCHEDULES

Architecture / Design Aptitude Test		
Paper 1 : 10.00 am to 12.00 noon	Friday	June 22, 2007
Paper 2 : 2.00 pm to 4.00 pm		
Website Release of Course Allocation	Friday	June 29, 2007
Despatch of Final Offer of Admission	Tuesday	July 03, 2007

REPORTING DATES FOR SELECTED CANDIDATES

INSTITUTE	ORIENTATION	REGISTRATION	CLASSES BEGIN
IIT BOMBAY	July 26, 2007	July 24, 2007	July 25, 2007
IIT DELHI	July 27-28, 2007	July 28, 2007	July 30, 2007
IIT GUWAHATI	July 30, 2007	July 31, 2007	August 2, 2007
IIT KANPUR	July 24-27, 2007	July 28, 2007	July 30, 2007
IIT KHARAGPUR	July 23, 2007	July 23, 2007	July 24, 2007
IIT MADRAS	July 30, 2007	July 30, 2007	August 2, 2007
IIT ROORKEE	July 26, 2007	July 25, 2007	July 27, 2007
IT-BHU VARANASI	July 23, 2007	July 23, 2007	July 25, 2007
ISMU DHANBAD	July 23, 2007	July 21-22, 2007	July 23, 2007